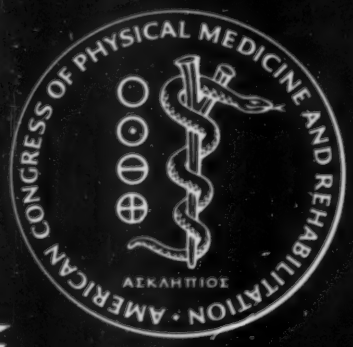

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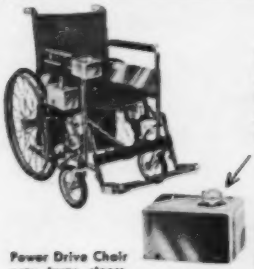

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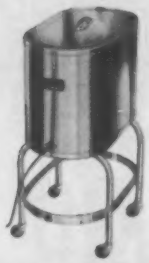

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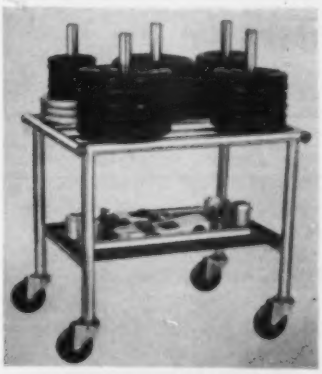

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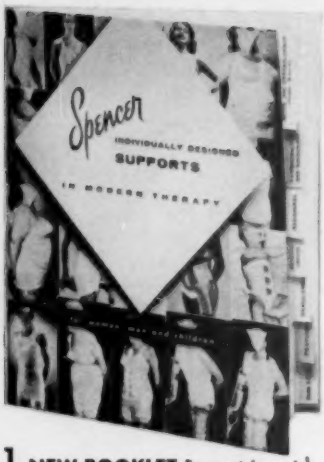

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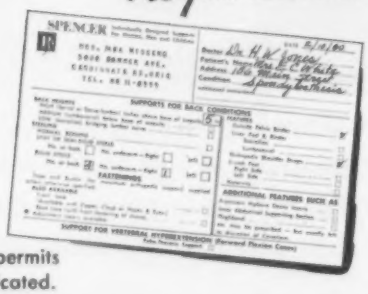

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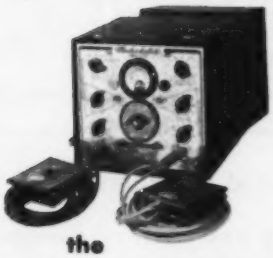

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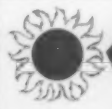

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Rehabilitation Operation for 10,000 Moroccan Paralysis Victims

G. Gingras, M.D.
Montreal, Quebec, Canada
and
M. H. L. Desmarais, M.D.
Winnipeg, Manitoba, Canada

● Paralysis appeared in the Meknes area at the end of August, 1959, and by the end of November almost 10,000 Moroccans were affected. In mid-September, unable to cope with the situation, the Government and Moroccan Red Crescent appealed for assistance to World Health Organization (WHO) and the League of Red Cross Societies. Two WHO experts were dispatched to Morocco to investigate and they traced the cause of the paralysis epidemic to poisoning by tri-ortho-cresyl-phosphate contained in adulterated cooking oil. Dr. Dennis Leroy, a French professor, sent later as WHO expert on matters of re-education, submitted recommendations concerning establishment of rehabilitation centers, equipment, treatment, personnel and training. Findings revealed that 50 per cent of the victims were children and adolescents and that women were affected in greater number than men. Through its National Societies, the League provided equipment, financial assistance and 55 professional rehabilitation personnel from 15 countries to treat victims and to train Moroccan personnel. Locales were found and one indoor and four outdoor hospital treatment centers were established. Special 10-day courses for Moroccan nurses aides have been started to qualify them to assist physical therapists. A special one-year physical therapy training course is planned for selected Moroccan nurses. Six weeks after organization of the rehabilitation operation, 6,991 patients had been thoroughly evaluated and tested. Preliminary statistics show that of this number six per cent will remain quadriplegics, approximately 15 to 20 per cent have minimal disability and the balance will require long-term treatment. The size and urgency of the problem dictate group therapy treatment rather than individual treatment.

The world was shocked to read in mid-November, 1959, that human greed was the underlying cause of an outbreak of over 10,000 cases of paralysis in Morocco.

The first cases appeared between August 31 and September 2, 1959, in the city of Meknes and rapidly spread throughout various parts of the country; by the third week of September, 200 to 300 new cases were being reported daily. Because opinion was divided as to whether the disease was due to an infection or to a toxic factor, and because it was unable to trace the cause of the mysterious "epidemic" to a common etiology, the alarmed Moroccan Government finally appealed to the World Health Organization (WHO) for urgent assistance.

WHO Detection

In response, Doctors H. Smith and J. M. K. Spalding of Oxford visited Morocco from September 25 to October 2, 1959, as WHO temporary consultants to investigate the cause of the paralyzing disease. Study of the epidemiologic and statistical information already collected by the Moroccan health authorities, and made available to the WHO experts, revealed that the incidence was still rising rapidly, the outbreak was centered on Meknes and the nearby towns of Sidi Slimane and Khemisset and that only the Moslem Moroccans of the artisan class were affected. After investigating both the infective and toxic theory, the cause of the paralysis was proved to be due to intoxication by tri-ortho-cresyl-phosphate found in a dark-colored cooking oil which recently had appeared on the local markets under a well-known trade name. The source of the toxic substance was traced to a lubricating oil used to flush aviation engines and sold as surplus material by the soon departing United States Air Force to a Moroccan dealer. The lubricating oil was eventually purchased by unscrupulous Moroccan merchants who, to realize greater profit, mixed this cheaply bought lubricant with edible oil in proportions from 5 to 80 per cent and put the contaminated mixture on the market as a cooking oil. This accounted for the sparing of other ethnic and religious groups. Jews have their own supervised markets; pilgrims ordinarily bring their own food; Europeans and wealthier Moroccans could afford a better quality of cooking oil while the

Executive Director, Rehabilitation Institute of Montreal; Professor and Director, School of Rehabilitation, Faculty of Medicine, University of Montreal. From December, 1959, to February 12, 1960, Senior League Delegate and Medical Liaison Officer of the League of Red Cross Societies' International Relief Action for Moroccan Paralysis Victims.

Director of the Departments of Physical Medicine of the Municipal Hospitals, St. Boniface Hospital and Misericordia Hospital of Winnipeg, Manitoba. From February 12 to May 15, 1960, Senior League Delegate and Medical Liaison Officer of the League of Red Cross Societies' International Relief Action for Moroccan Paralysis Victims.

Read at the 3rd International Congress of Physical Medicine, Session on Neuromuscular Diseases, Washington, D. C., August 24, 1960.

very poor could hardly afford to purchase any oil at all.

Clinical Picture

Examinations conducted shortly after the appearance of symptoms showed are flexia and a flaccid paralysis mainly of the distal parts of the upper and lower extremities. Symptoms were symmetrical in the majority of cases. Paresthesia and loss of superficial sensitivity with a glove-like or sock-like distribution were noted by a number of examiners, but rarely confirmed on more intensive investigation or during regular followup. Patients complained that the affected limbs felt cold, and this was confirmed on palpation. However, interestingly enough, if the temperature of the limbs were elevated somewhat by immersion in warm water prior to testing or treatment, the sensitivity phenomena disappeared in almost all cases. Muscle atrophy became particularly evident in the upper extremities especially involving the flexors and opponens of the thumb. In the lower extremities, drop foot is the common denominator and victims are easily identified at a distance by their "steppage gait." There were no urinary or intestinal symptomatology. In conclusion, the clinical picture and evolution is essentially one of acute peripheral neuritis.

Later statistics revealed that 50 per cent of the victims are children and adolescents from 5 to 18 years of age, and that adult women are affected in greater proportion than men. This is explained by the fact that women ingested more of the contaminated oil through the tasting of the food during preparation and eating all their meals at home whereas many of the men work outside and have their mid-day meal away from their homes. There have been no reported deaths directly attributable to the intoxication.

Previous T.O.C.P. Intoxications

This form of poisoning has been reported on in the past in several countries, but never on such a large scale. Tri-ortho-cresyl-phosphate is highly toxic to the peripheral nervous system; it was held responsible for the great outbreak of paralysis in the United States in the early 1930s and in Germany and Switzerland during World War II. In the United States it was known as "Jake Paralysis" because the toxin was present in a soft drink called Ginger Jake or Jamaica Ginger. In Switzerland, 80 soldiers suffered severe polyneuritis in 1940 and, although prompt and adequate measures were available and applied immediately, the Swiss victims show sequelae of the toxic paralysis even 20 years after the ingestion of a single massive dose of the toxicant. Thirty-three per cent of these victims are still totally disabled.

Rehabilitation Plan

An outbreak of 10,000 cases of paralysis in a population of 10 million is a staggering situation in any part of the world. It is disastrous when it occurs in a country like Morocco, a four-year old nation, completely lacking in rehabilitation personnel and equipment. Because of this lack a French professor Denis Leroy, was sent to Morocco by WHO as a temporary consultant from October 23 to November 6, 1959, to study the incidence and evolution and to make recommendations with reference to the possibilities of organizing rehabilitation centers.

International Relief Action

As it was realized by the Moroccan Government that its national resources could not cope with the situation, an appeal was made to the League of Red Cross Societies for assistance with urgent rehabilitation measures. After a meeting on November 18 at Geneva between representatives of WHO, the Moroccan Government, the League of Red Cross Societies and other international agencies, the League launched an emergency appeal to its national member societies to cover a certain proportion of the medical and material needs while WHO, the Moroccan Government and other United Nations organizations endeavor to provide the remainder.

The response was immediate and heartwarming. More than 200 tons of material and equipment were delivered mainly by air from 14 countries, funds

from eight countries and 55 professional rehabilitation personnel (14 physicians, most of whom are specialists in physical medicine and rehabilitation, 31 physical therapists and 10 nurses), arrived within six weeks from 15 countries. WHO provided an Administrator Delegate, two physical therapists and two units of electromyograph apparatus. The United Nations Childrens Fund (UNICEF) provided equipment for child patients.

Moroccan Program

The Moroccan Government's program to provide facilities and welfare payments is well under way. A special division was created within the Ministry of Health to operate the Paralysis Program. This division is headed by Doctor A. Faraj, one of the first pioneers in the field of health in Morocco.

Establishment of Indoor and Outdoor Rehabilitation Centers. In the program's special division are integrated WHO and League personnel to staff:

Four rehabilitation centers for treatment on an outdoor basis in Sidi Slimane, Sidi Kacem, Khemisset and Meknes;

One hospital rehabilitation service (indoor) established in a reconverted former military hospital in Alhucemas; and

One hospital rehabilitation center (indoor) being established in Fez.

Because of the geographic distribution of the toxic paralysis cases the possibility of opening other treatment centers is being studied. This would enable the treatment of patients nearer to their homes instead of having to transport them hundreds of kilometers from their communities.

The rehabilitation centers are all improvised and established in large depots, hangars and abandoned barracks, and each is equipped for simple and uniform mechanotherapy and hydrotherapy according to the plans outlined by Professor Leroy. Each center is designed and equipped as a unit to treat 400 patients excepting Sidi Kacem, where double facilities lend themselves to two units, permitting the treatment of 800 patients daily.

Staffing. The Senior Delegate of the League of Red Cross Society is in charge of directing, from Headquarters in Rabat, all medical and technical aspects of the program. All staff members from all sources operate under him. Each center is provided with a chief physiatrist, deputy chief physician, chief physical therapist and a staff of physical therapists and nurses. The government provides, through provincial health offices, supporting personnel and social workers. Adhering to initial policy, staffs are of mixed nationalities, thus permitting the maximum utilization of individual experience and knowledge of languages. The Canadian personnel is particularly useful in this respect as they are proficient not only in the English but also in the French language; the latter being the second language of Morocco.

Medical Testing and Treatment. Although the international personnel arrived at their postings in the field while renovation and alterations were still in progress, they nevertheless proceeded with the first step, testing and evaluating patients. A standard and precise record and identification system was developed which also is used by social workers since welfare payments are graduated according to the degree of paralysis and the patient's role in the family unit.

Treatment now is being given in all the centers. The majority of patients are treated on the outdoor basis, reporting to the centers by their own means or transported by government vehicles (which were scarcely available at first). As the usual practice of individual treatment is impossible with such a mass of patients, and since symptoms are similar, patients are divided and treated in groups of approximately 10 each and the therapy classes are led by the nurses and physical therapy aides under the general supervision of qualified therapists. However, individual treatments and intricate or special therapeutic measures that may be prescribed by the physiatrists are applied only by the qualified physical therapists.

The plan for the care of the approximately 600 quadriplegics and 1,000 children is to accommodate them in the former military establishment which is

being transformed into an indoor treatment center in Fez, where the children will have the benefit of combined treatment and schooling. Plans are being drawn up to bring these children from all provinces into Fez, thus relieving somewhat the load on the outdoor centers.

Statistics provided by the Ministry of Health at the end of January, 1960, listed a total of 9,991 victims, of whom 6,242 were examined and tested by the international teams by mid-February. These preliminary statistics would indicate the following prognosis: six per cent will remain quadriplegics, confined to bed or wheelchair; 15 to 20 per cent will need short term or no treatment; and the balance will require treatment for extended periods of time. By mid-April, a total of 9,081 patients had been examined and tested.

As muscle activity is prone to variations during the clinical evolution and between followup, electromyographic studies were carried out in a number of selected cases, not only for statistical information but also to note the variations, permitting immediate appropriate measures such as intensification or reinstitution of treatment. This study was carried out by Dr. Erland Svennilson of Stockholm who soon will publish his findings.

Referring to the past experiences of others in similar outbreaks, it is too early to forecast a definite prognosis. All that is clear at the moment is that provision must be made for long term treatment.

Training of Moroccan Personnel. Special introductory 10-day short courses have been started to train Moroccan male and female nurses aides to send into the field as physical therapy aides. The goal is to provide 250 physical therapy aides; more than 100 had been trained by April, and it is reported that their services are proving very useful. After postings to the centers they receive additional instruction and practical training on the job.

With the approval of the government, WHO has developed a special 12-month physical therapy training course for selected Moroccan nurses. This will be the first School of Rehabilitation in North Africa, and the Moroccan graduates will enable the foreign staff to be released. The plan is the basis for the League's agreement to ask the National Societies to continue professional aid through 1960. This course will be established in line with the recommendations of the World Confederation for Physical Therapy, Second Congress, held in New York on June 20, 1956, pertaining to the initiation and development of programs of Physical Therapy Education and Service in under-developed countries. This type of program already has proved very satisfactory in Venezuela and Guatemala.

New Problem

Upon discovery of the tri-ortho-cresylphosphate as the toxic agent there was confiscation and destruction of all suspicious edible oil in retail establishments as well as impounding of all stocks in refineries until tested; but in spite of warnings to the public, small quantities of the toxic oil seeped into isolated communities and cases have continued to appear at widely separated points. This occurred because the rural population makes infrequent visits to markets for provisions which they purchase in quantity, because they have little contact with the exterior and also because the criminal merchants deliberately dispatched the contaminated cooking oil to remote areas hundreds of kilometers from Meknes after the public warnings were issued. In order to examine and evaluate these isolated cases, the Senior League Delegate built two mobile teams consisting of a doctor and physical therapists to visit patients in the remote areas. By mid-April, 1,517 of these patients had been tested and evaluated, and recommendations were made for the transfer of the patients requiring treatment to appropriate rehabilitation centers.

International Cooperation and Liaison

The headquarters staff makes regular field trips to the centers to maintain close contact and to make on the spot decisions jointly to solve problems.

This is one of the largest and most tragic peace-time operations in which physical medicine and rehabilitation has

been called upon, and we must continue to assist and help prepare the burdened Moroccan collaborators who will have to carry on the rehabilitation task.

We share a common interest and responsibility, as well as a tremendous opportunity — the welfare of the people. The speed and volume of international aid that has come to the help of a stricken nation is a shining example of international sharing of knowledge and skill and illustrates the fact, as stated by Doctor Howard A. Rusk when informed of the action, "that medicine and human compassion know no international boundaries."

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Deaths

DR. HARRY BRITENSTOOL

Harry Britenstool, New York City, died of cerebral thrombosis on March 8, 1960. He was born June 13, 1875 in Rochester, N. Y., and was graduated from Columbia University in New York and licensed to practice medicine in New York City in 1901. He was chief medical consultant at St. Clare's Hospital. He also was a medical consultant at the Hospital for Joint Diseases of which he was one of its founders.

DR. CHARLES EDLIN

Charles Edlin of Waterbury, Conn., died in Mt. Sinai Hospital, Hartford, of nephrosclerosis and diabetes on March 16, 1960. Dr. Edlin was born in Hartford, Conn., on October 10, 1900. He was graduated from Tufts College in Boston and licensed to practice medicine in 1925.

DR. FRANK LEHMACHER

Frank Lehmacher, Lakewood, N. J., was born in 1878. He was graduated from Columbia University in 1902 and licensed as an M.D. in 1903. He was associated with the Paul Kimball Hospital, Lakewood, N. J., where he had passed away on November 20, 1959. His death was caused by a cerebral hemorrhage.

DR. PATRICK McFADDEN

Patrick J. McFadden of Erie, Pa., passed away in January, 1960. His death was caused by arteriosclerotic heart disease. Dr. McFadden was born in Williamsport, Pa. on March 8, 1901. He was graduated from Jefferson Medical College in Philadelphia in 1925 and was licensed to practice medicine in Pennsylvania in 1926. He was a veteran of World War II and a member of the staff at the VA Hospital in Erie, Pa.

Development of Objective Predictors of Recovery in Hemiplegic Patients

Jan H. Bruell, Ph.D.
and
Jerald I. Simon, B.A.
Cleveland

● Predictions as to whether a patient will recover after a cerebral vascular accident are made frequently on a subjective basis, and the validity of such predictions depends largely on the experience of the clinician who makes the prognosis. Data will be presented which suggest the distinct possibility of developing objective methods of prediction. Two groups of 40 hemiplegic patients form the two samples of this study. It was found that hemiplegic patients who fail to recover from the effects of a cerebral vascular accident (F-patients), (a) tend to be older, (b) tend to have higher systolic blood pressure, and (c) tend to enter physical therapy later after the c.v.a. than patients who recover (R-patients). Failure to recover was indicated if a patient remained wheelchair-bound in spite of physical therapy, while recovery was defined as a progression from a wheelchair-bound status at the beginning of physical therapy to an ambulatory and fully independent status at its conclusion. Measures of the three factors which differentiated between F-patients and R-patients were used as predictors of recovery. A composite score based upon all three factors was found to predict recovery better than scores based upon two or one factor only. Shortcomings of the method used in the development of the predictor scores, and ways to cope with these shortcomings in future studies will be discussed.

Predictions as to whether a patient will recover after a cerebral vascular accident (c.v.a.) are made frequently on a subjective basis, and the validity of such predictions depends largely on the experience of the clinician who makes the prognosis. Data will be presented which suggest the distinct possibility of developing objective methods of prediction. The present study grew out of a minor project which, at first, appeared unrelated to the problem of prognosis. We wanted to know whether there is a basis in fact to the belief that hemiplegic patients who receive physical therapy relatively early in the course of their disease fare better than patients who receive such treatment at a relatively later time. Dinken[1] goes as far as to call it an "*axiomatic principle*" that "physical treatment and rehabilitation of the hemiplegic patient should be instituted as early as possible," and others have expressed similar views. This issue of early treatment will be taken up first; it will lead directly to a consideration of the main topic of this paper.

Early Treatment and Prognosis

This part of the study was designed to test whether hemiplegic patients who receive physical therapy early in the course of their disease are more likely to recover than those patients who receive treatment at a relatively later time.

Method. The study was conducted at Highland View Hospital, a metropolitan rehabilitation center with about 100 beds for hemiplegic patients. In this center, at the beginning and conclusion of physical therapy, the performance of each patient is rated on a scale consisting of the following five categories: (1) bed-bound, (2) wheelchair-bound, partially independent in activities of daily living, (3) wheelchair-bound, completely independent in activities of daily living, (4) ambulatory, if guided, assisted or supervised, and (5) ambulatory, completely independent.

Two categories of patients were included in this study: a failure group (F) consisting of patients who, in spite of therapy, remained wheelchair-bound, i.e., patients with an initial and final rating of two; and a recovery group (R) consisting of patients who at the beginning of treatment were wheelchair-bound, and on discharge from therapy were ambulatory and completely independent, i.e., patients with an initial rating of two and a final rating of five. Two samples of 40 patients, each consisting of 18 F-patients and 22 R-patients (total $N = 80$), were drawn from among patients hospitalized between June, 1957, and July, 1959, and for each patient the days intervening between the cerebral vascular accident and the initiation of physical therapy (c.v.a. to PT) were obtained from hospital records.

Department of Physical Medicine and Rehabilitation, Highland View Hospital, and Department of Psychology, Western Reserve University, Cleveland, Ohio. The junior author is student at the School of Medicine, University of Chicago.

This study was supported by Grant B-1041 from the National Institute of Neurological Diseases and Blindness, U. S. Public Health Service.

Read at the 3rd International Congress of Physical Medicine, Session on Medical Problems Diagnosed or Treated by Physical Medicine, Washington, D. C., August 26, 1960.

Results. In both samples of this study those patients who recovered (R-patients) entered physical treatment earlier after the cerebral vascular accident than those patients who failed (F-patients). The difference is highly significant statistically for the second sample, and for both samples combined (table 1).[2]

This finding confirms previous reports[3] of a relationship between early initiation of physical therapy and successful rehabilitation. But does it indicate, as was often implied, a cause-effect relationship between these two factors? In other words, is it early treatment that leads to improvement? Do R-patients succeed because of early treatment, and do F-patients fail because treatment was delayed? Certainly, such an interpretation of the data is possible, but a more plausible alternative hypothesis can be advanced.

It can be hypothesized that the two groups differed with regard to the degree of disability, the F-group having been more disabled than the R-group. This one factor of disablement would explain why F-patients both stayed longer in a general hospital, i.e., started physical therapy later, and failed in therapy.

Degree of Disability and Prognosis

In the preceding section it was shown that patients who started physical therapy early after the cerebral vascular accident recovered more frequently than those patients who started physical treatment at a relatively later time. This was explained by assuming that patients who started late (and failed) were more disabled than those patients who started early (and succeeded). This hypothesis was tested next.

Method. The patients referred to before were used again. To test the hypothesis, independent measures of disability were needed — that is, measures other than length of hospitalization in a general hospital, or outcome of physical therapy. It was decided to use two items of information recorded in the charts of all patients — the age of the patient, and his systolic blood pressure on admission. These items were used as measures of disability on the assumption of a positive correlation between age and disability, and systolic blood pressure and disability. While the validity of these two assumptions remains debatable, most will agree that, speaking statistically, the physical condition of older patients tends to be poorer than that of younger patients. Similarly, there is evidence to indicate that over the years high blood pressure may cause several small cerebral vascular accidents, so-called little strokes.[4] These minor strokes may at the time go unnoticed, their cumulative effect, however, may lead to marked disability.

Results. Age and systolic blood pressure differentiated between F-patients and R-patients (table 1). Patients in the F-group were significantly older and had significantly higher blood-pressure than patients in the R-group.

Thus, if one accepts age and systolic blood pressure as valid measures of disability, it may be concluded that the F-group was more disabled than the R-

Table 1: Single Measures

Measure	Sample	Group F			Group R			Difference Between Means	Probability
		N	Mean	S.D.	N	Mean	S.D.		
C. V. A. to Physical Therapy	1	18	58.7	40.6	22	17.7	20.8	41.0	>.05
	2	18	74.3	47.4	22	19.6	30.2	54.7	<.01
	1 & 2	36	66.5	44.2	44	18.8	25.5	47.7	<.01
Age	1	18	68.1	12.7	22	59.8	11.2	8.3	<.05
	2	18	62.2	8.7	22	58.9	12.6	3.3	>.05
	1 & 2	36	65.1	11.1	44	59.4	11.8	5.7	<.05
Systolic Blood Pressure	1	18	167.1	27.5	22	148.2	33.4	18.9	<.05
	2	18	162.7	25.7	22	146.2	27.7	16.5	<.05
	1& 2	36	164.9	26.4	44	147.2	30.3	17.7	<.01

group. Moreover, it may be inferred that the members of the F-group started rehabilitation training later than those of the R-group because they were more disabled and recuperated slower from the immediate effects of the stroke. Finally, the failure of the F-group can be attributed to its disablement rather than to its delayed treatment.

Composite Predictors of Recovery

The findings of the preceding sections provide the background for a consideration of the main topic of this paper. Three factors were found to differentiate between R-patients and F-patients: (1) age (factor A), R-patients were younger; (2) blood pressure (factor B), R-patients had lower systolic blood pressure; and (3) time between cerebral vascular accident (c.v.a.) and physical therapy (factor C), R-patients started physical therapy earlier after the c.v.a. than F-patients. It will be shown how measures of these three factors can be used for the prognosis of recovery.

Method. To utilize the information provided by each of the three measures, composite scores were derived from them by addition. Obviously, such composite scores could not be obtained by adding the raw scores. To make addition possible, the three sets of raw scores had to be transformed in such a way as to yield distributions with equal means and equal standard deviations. This was achieved by a T-score transformation which reduced the original measures to a common scale with a mean of 50 and a standard deviation of 10. By adding and averaging these T-scores, three two-factor measures — $(A + B)/2$, $(A + C)/2$, and $(A + D)/2$ and one three factor measure, $(A + B + C)/3$, were obtained. Addition was meaningful because it was found that correlations between factors were low ($r_{AB} = .12$, $r_{AC} = -.22$, $r_{BC} = -.10$) and not significant. The composite scores were used to compare the R-patients with the F-patients.

Results. The results are summarized in Table 2. The two factor scores AB, AC, and BC, separate F-patients from R-patients more effectively than the single factor scores A, B, and C. Best separation of groups, however, is obtained when the three factor scores ABC are used. This finding is reflected in the increase in the *t*-ratio as group comparisons are based upon one, two, and, finally, three factors. It is noteworthy that the difference between group means remains the same for all combinations of factors. A change occurs only in the variance (S.D.^{2}) associated with the respective means. Variance decreases as factors are added. This decrease in variance is responsible for the increase in the *t*-ratios.

Entered at the bottom of table 2 are results obtained with ABC scores computed separately for each of the two samples of 40 patients. Again there exists a highly significant difference between R-patients and F-patients. The results are identical with those presented in the upper part of the table where 80 instead of 40 cases were used for computing T-scores. The *t*-ratios obtained for the samples of 40 patients are not directly comparable with the *t*-ratios obtained for the entire group of 80 patients because the former are based upon fewer cases.

The fact that composite scores separate groups more effectively than single factor scores is expressed also in the biserial coefficients of correlation entered in the last column of table 2. The value of these coefficients increases in proportion to the number of factors making up the measure. This indicates that with the aid of composite scores patients would be less often misclassified than when single factor scores were used for the same purpose of classifying. That is to say, patients would be less often judged F-patients when really they are potential R-patients, and vice versa. Misclassification would occur least often when classification is based upon the three factor ABC scores.

The differentiation between groups obtained with the ABC scores is presented in still another and possibly more informative way in figure 1. This figure shows the proportion of patients recovering within each of the seven score intervals indicated on the abscissa of the graph. For example, the graph indicates that in

Table 2: Composite Scores

Factor Combination	Sample	Group P			Group R			Difference Between Means	t	P	Biserial r
		N	Mean	S.D.	N	Mean	S.D.				
A	1 & 2	36	54.6	10.0	44	49.4	10.3	5.2	2.27	<.05	.31
B	1 & 2	36	54.8	9.0	44	48.8	10.5	6.0	2.67	<.01	.37
C	1 & 2	36	54.6	11.0	44	48.7	7.1	5.9	2.85	<.01	.38
A & B	1 & 2	36	54.7	7.2	44	49.2	7.4	5.5	3.22	<.001	.44
A & C	1 & 2	36	54.6	5.5	44	49.1	5.8	5.5	4.34	<.001	.55
B & C	1 & 2	36	54.7	6.6	44	48.9	6.6	5.8	3.91	<.001	.50
A & B & C	1 & 2	36	54.6	4.6	44	49.0	5.2	5.6	5.03	<.001	.62
A & B & C	1	18	55.3	6.0	22	48.8	4.9	6.5	3.52	<.001	.66
A & B & C	2	18	55.3	4.2	22	49.4	5.6	5.9	3.70	<.001	.64

this study less than 50 per cent of the patients with an ABC score larger than 54 recovered. A linear relationship between ABC scores and chances for recovery is suggested.

Discussion

It was our intention to illustrate a method which, in the future, may help to develop objective predictors of recovery. The data presented here were not intended for clinical use as the discussion that follows will indicate. In the interest of future better studies shortcomings of the present research and possible ways to cope with them shall be pointed out.[5]

Criteria of success and failure. Ratings of status of patients on entering and terminating physical therapy were used as criteria of success and failure. These ratings were made by qualified physical therapists, and were *assumed* to be reliable. However, an actual statistical evaluation of the reliability of these ratings was not undertaken. Because the reliability of the ratings was not known, only patients with widely differing characteristics were included in this study. Misclassification of a wheelchair-bound patient (F-patient) as ambulatory (R-patient), and vice versa, was highly unlikely. While the use of extreme groups minimized the possibility of misclassification, it restricted the study, and consequently the interpretation of results, to a selected segment of the total population of hemiplegic patients. The wide range of patients who improve partially, e.g. from "wheelchair-bound" (rating 2) to "ambulatory, if assisted," (rating 4) was excluded.

In any future study at least two steps will have to be undertaken to deal with this situation. First, a system will have to be developed which will permit a categorization of all hemiplegic patients reliably, that is, with a minimum number of misclassifications. How many such misclassifications are likely to occur will have to be known. Secondly, it should be obvious that a five point rating scale as used in this study, does lump together in the same category patients with widely differing characteristics. In other words, such a rating scale does not exhibit a high degree of discrimination. To be of use in a clinical setting, a more differentiating system of categories is desirable. In short, future research will have to be directed toward reliable and more discriminating classification procedures.

Predictor Variables. The reliability of predictor variables will have to be considered as well. Three such variables were used in this study: age of the patient (factor A), systolic blood pressure on admission (factor B), and days elapsed between the cerebral vascular accident and the initiation of physical therapy (factor C). Only the measures obtained for A can be considered reliable. Systolic blood pressure is easily influenced by many factors and thus is known to vary within a wide range. In the present study this normal variability was undoubtedly increased by the use of drugs. If, in the future, systolic blood pressure is to be used

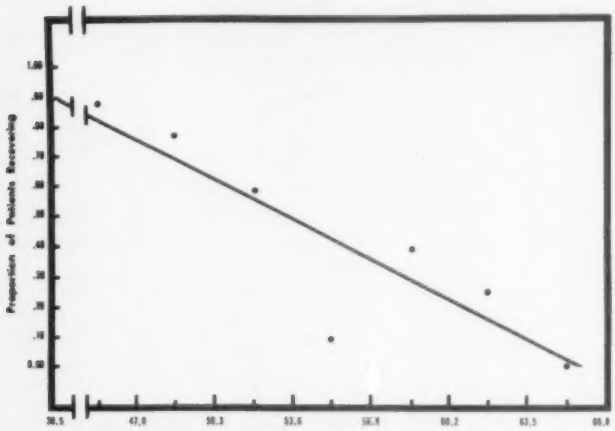

Fig. 1 — ABC Scores.

as a predictor, it will have to be measured under conditions kept constant for all patients. As to days elapsed between stroke and initiation of physical therapy, this measure can be expected to vary for other than medical reasons, e.g., because of delays in transfer from a general hospital to a rehabilitation center due to extraneous administrative reasons. In this study, this measure was taken from hospital records and no attempt was made to check whether it measured what it was supposed to measure, namely, the period required to recover from the acute condition following a cerebral vascular accident. Extraneous factors influencing this measure would have to be eliminated in the future.

Obviously the proper selection of predictors is of prime importance. While some reasons were given for the choice of the three measures used in this study, it must be admitted that an important reason for the particular selection of measures consisted in their ready availability. The three measures used were recorded in the charts of all patients. There is no reason to assume that better predictors could not be found, and the search for such better predictors must constitute one of the main objectives of future investigations.

Another problem raised by this study concerns the optimum number of predictor variables to be used. Evidence was presented to the effect that the composite scores utilizing the information provided by all three predictor variables discriminated much more effectively between groups than the measures composed of two predictors, or the single factor measures. One is tempted to extrapolate this finding, and to hypothesize that prediction will become increasingly accurate as predictor variable is added to predictor variable. Such an extrapolation is contradicted by much empirical evidence. On the contrary, theoretical considerations and research findings indicate that the stability of predictions is best when the number of predictor variables is kept to a minimum. Research must not proceed in the direction of adding an infinity of predictor variables, but in the direction of selecting among the infinite number of possible variables the ones which correlate best with the criterion variables.

Cross validation. Stated simply, cross-validation consists of making sure that an empirically developed predictor measure works when applied to a new sample. In practice this means that unless a study such as this was replicated at least once and with similar results, no confidence can be placed in the predictor measure. This is why in this study two samples of 40 patients were drawn and analyses were carried out for each sample separately. It was shown that, particularly for the composite measure, the results were identical for both samples. This, however, is not sufficient evidence to indicate that the predictor will work if applied to a

patient population in another treatment center. The two samples used in this study were not necessarily representative of all hemiplegic patients. The patients of this study were a selected group due to the particular admission procedures of this hospital, due to the fact that most of them came from a lower income class in a metropolitan area, and, certainly for many other reasons. The point is that unless the sample used for cross-validation is representative of the population to which the predictor measure is to be applied in the future, the validity of the predictor is suspect. It should be obvious that this casts doubt upon the value of measures developed by researchers in any one institution, and suggests that the development of valid predictors will call for cooperative research of many investigators in many treatment centers.

Summary

It was found that hemiplegic patients who fail to recover from the effects of a cerebral vascular accident (F-patients), (a) tend to be older, (b) tend to have a higher systolic blood pressure, and (c) tend to enter physical therapy later after the c.v.a. than patients who recover (R-patients). Failure to recover was indicated if a patient remained wheelchair-bound in spite of physical therapy, while recovery was defined as a progression from a wheelchair-bound status at the beginning of physical therapy to an ambulatory and fully independent status at its conclusion.

Measures of the three factors which differentiated between F-patients and R-patients were used as predictors of recovery. A composite score based upon all three factors was found to predict recovery better than scores based upon two or one factor only. Shortcomings of the method used in the development of the predictor scores, and ways to cope with these shortcomings in future studies were discussed.

An introduction to all statistics used in this paper can be found in Reference 2. For a thorough discussion of the points covered here the reader is referred to Reference 5.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Management of Emotional Barriers to Rehabilitation in Cerebral Palsied Adults

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● There is general agreement that a large proportion of cerebral palsied individuals suffer from emotional problems which interfere with rehabilitation efforts. Agreement is lacking, however, concerning the kinds of problems seen and appropriate methods for managing them. This investigation suggests that not one but several personality patterns are represented in this group. **Procedure:** 72 consecutive cerebral palsy patients applying for help to the United Cerebral Palsy Association of Los Angeles County Vocational Training Center were studied psychiatrically; information was recorded in narrative form and on specially prepared rating scales. **Findings:** 82 per cent of the subjects manifested the signs and symptoms of problems sufficiently severe to interfere with rehabilitation efforts, although not all were severe enough to warrant a psychiatric diagnosis. Four different personality patterns could be reliably distinguished: schizoid patterns, denial patterns, passive-dependent patterns, and sublimation patterns. The first three of these were maladaptive. **Conclusions:** most of the problems seen are amenable to management by the rehabilitation team without specialized psychiatric intervention. Appropriate management requires recognition and use of the constructive characteristics of each personality pattern. These characteristics and suggested methods for handling them are discussed.

Although there is general agreement that a large proportion of cerebral palsied individuals suffer from emotional problems of sufficient severity to interfere with rehabilitation efforts, there is little agreement concerning the kinds of problems seen in this group. Two recent studies report such problems in 75 per cent or more of cerebral palsied adults.[1, 2] Descriptions of the kinds of difficulties seen, however, range from shy and meditative behavior[3] to behavior characterized by revolt against authority.[4] Linde and Patterson feel that there are no personality patterns or emotional problems which can be considered specific for patients suffering from cerebral palsy.[5] In view of the present confusion concerning the kinds of psychologic difficulties associated with cerebral palsy, development of rational and effective treatment is difficult or impossible. The investigation reported here is an attempt to describe and classify the emotional problems seen in cerebral palsied adults in order to resolve some of the contradictions in the literature on the subject. Treatment approaches useful to rehabilitation personnel also are suggested.

Method

Subjects. The sample studied included all of the cerebral palsied individuals who applied for help to the United Cerebral Palsy Association of Los Angeles County Vocational Training Center between June 1, 1957, and January 31, 1959, and who were aged 16 or over at the time of initial contact. Although 76 subjects met the above criteria, two were not evaluated psychiatrically because of scheduling difficulties. The remaining 74 provided the data for this investigation.

Twenty-eight per cent of these subjects were referred from the State Vocational Rehabilitation Service, 13 per cent from clinics or private physicians, and eight per cent from special cerebral palsy public schools. The remainder came from various other sources. Sixty-five per cent were men, and 35 per cent were women. The age range was from 16 years to 49 with a median of 22. As to ethnic background 91 per cent of the group were white, four per cent Negro, four per cent Mexican, and one per cent Japanese. Sixty-two per cent were Protestant, 19 per cent Catholic, 11 per cent Jewish, and eight per cent claimed other religious affiliations. The claim cannot be made that these subjects constitute a representative sample of the population of cerebral palsied adults in this geographic area. It seems likely, however, that they are fairly typical of patients who seek rehabilitation help for handicaps associated with cerebral palsy.

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This study was completed as part of Special Project No. 65-58 which was supported by a grant from the Office of Vocational Rehabilitation, Department of Health, Education, and Welfare.

Read at the 3rd International Congress of Physical Medicine, Session on Cerebral Palsy, Washington, D. C., August 25, 1960.

The diagnosis of cerebral palsy was made in each case by the medical staff of the Vocational Training Center. The distribution of diagnostic groups was spastic 56 per cent, athetoid 25 per cent, mixed 11 per cent, and other types eight per cent. Fifty-three per cent of the subjects were quadriplegics. Since upper extremity deficit is more of a problem in vocational training than lower extremity difficulty, a crude estimate of overall severity of handicap can be obtained by considering upper extremity involvement alone. Upper extremity involvement was severe in 22 per cent, moderate to severe in 21 per cent, moderate in 14 per cent, and mild in the remainder.

Data collection. Shortly after being diagnosed as cerebral palsied and thus accepted for the study each subject was interviewed by a psychiatrist. The duration of each interview was one to one and one-half hours, and all subjects were interviewed by the same psychiatrist (Storrow). Interviews covered a number of areas previously selected as likely to be of importance, e.g. personal history, family history, current emotional adjustment, and attitudes toward disability. Within these limitations, however, each subject was given freedom to tell his own story in his own way. Data thus elicited were recorded in a narrative psychiatric report and, in addition, on a specially prepared set of rating scales which permitted IBM card tabulation.

Results

Prevalence of emotional maladjustment. Review of the tabulated data suggests a high prevalence of emotional maladjustment in individuals suffering from cerebral palsy. Forty-eight per cent of the subjects studied manifested the characteristic signs and symptoms of functional psychiatric illness. The illnesses seen were: psychoses three per cent, psychoneuroses three per cent, personality or character disorders 41 per cent, transient situational personality disorders one per cent. Another 34 per cent of the subjects manifested emotional symptoms or problems of sufficient severity to interfere with rehabilitation efforts although not severe enough to warrant a psychiatric diagnosis. In all, 82 per cent of the subjects were emotionally maladjusted to some degree, a figure which confirms previous findings.[1, 2]

Personality patterns. Review of the interview data suggested that no single personality pattern or type of emotional maladjustment could be considered typical of this group. Using the data contained in the previously prepared narrative psychiatric reports it was possible to distinguish four separate personality patterns. These patterns are herein described.

1. Schizoid patterns. Patients in this group tend to retreat from attempts to cope with the environment into daydreaming or unrealistic planning which never results in action. They may be described by others as "dreamers." They tend to be shy and seclusive and may seem apathetic to an interviewer. Their relations with others are distant. Little or no hostility is expressed. When such behavior is marked, the diagnosis of schizoid personality may be applicable. Even more extreme cases may manifest the symptoms of schizophrenia.

2. Denial patterns. These patients manifest an intense need to see themselves as capable of competing on even terms with the non-handicapped in spite of obvious evidence to the contrary. They ignore their handicap and attempt to force others to agree with this self estimate. Lack of acceptance from others is seen as hostile, and thus there may be a strong paranoid flavor to their perception of their environment. Such individuals tend to seek employment beyond their capacity even when repeatedly rebuffed. Their interpersonal relationships are difficult because their behavior drives others away. Hostility and suspiciousness may be evident even in a brief evaluation interview. If the pattern described is rigid and extreme, such diagnoses as passive-aggressive personality, aggressive type; paranoid personality; or anti-social reaction may be applicable.

3. Passive-dependent patterns. Patients in this category tend to use their handicap to induce others to take care of them. They over-emphasize the severity of their handicap in terms of its effect

on their capacity to function independently. There is usually a history of clinging dependent behavior, of a marked need to please authority figures, and of uncritical acceptance of the opinions of others. Patients in this group who manifest the behavior described to an extreme degree may be diagnosed as passive-aggressive personality, passive-dependent type.

4. Sublimation patterns. These patterns are characterized by the seeking of socially acceptable substitute gratifications. These patients tend to have a realistic appraisal of their potential and to attempt more or less successfully to achieve within its limits. They may actually develop a talent they do have to a higher degree than they would if not handicapped, e.g. intellectual achievement. They seek out sources of help and use them actively and constructively. Usually they have been able to find and hold jobs in the past. Even if they have not held jobs in the past, their vocational goals seem realistic. They make and hold friends, and, if married, their adjustments to their spouses are reasonably smooth and unconflicted.

Classification of the patients in the sample according to the above criteria was found to be relatively easy. In only a few cases was there any question concerning the correct classification. The percentages of patients falling into each classification were as follows: Schizoid patterns 21 per cent, denial patterns 25 per cent, passive-dependent patterns 33 per cent, sublimation patterns 21 per cent. The reliability of this classification was tested by reclassifying one-half of the sample six months after the original classifications were made. The subjects to be re-classified were chosen at random by selecting every other case number. Only one subject was classified differently on the second occasion, and thus the reliability of this classification was considered adequate.

Relationships between the personality pattern classification and other variables were tested using the Chi-square technic. Personality pattern was not found to be related to either age or sex. As would be expected a significant relationship was found between personality pattern and severity of emotional maladjustment. Patients in the schizoid and denial groups tended to show marked evidence of maladjustment while those in the sublimation group tended to be well adjusted. Spastics were over-represented in the schizoid and denial groups while patients with athetoid, mixed, and other varieties of cerebral palsy were over-represented in the sublimation group. No relationship was found between personality pattern and severity of involvement.

Discussion

The personality pattern classification advanced in this paper offers an explanation of the lack of agreement between previous investigators concerning the kinds of emotional maladjustment seen in cerebral palsied patients. Our experience suggests that not one but several different personality patterns are seen in this group. Of four such patterns distinguished in this study only one, the sublimation pattern, can be considered adaptive. The other three are likely to be associated with rehabilitation difficulties. Our classification offers a key to the problem of providing rational and effective psychologic care to these patients in the hope of improving rehabilitation results.

The personality patterns are the end results of patients' attempts to maintain adjustment in the face of failure. The schizoid patient avoids the recognition of failure by isolating himself from competition and dreaming of success. Patients who use the denial pattern simply refuse to recognize their inadequacies and attempt to force others to do the same. Passive-dependent patients emphasize their helplessness and use it to justify their demands for attention and care. In each case the pattern serves a defensive function, that is, it prevents the fear of failure.

The maladaptive personality patterns can be altered only by helping the patients achieve some real success. Even small successes encourage further effort, and a series of successes makes the maladaptive patterns unnecessary. The first problem in rehabilitation, then, is to provide the patient with an opportunity for success

in such a way that his efforts will not be blocked by fear.[6]

The following are some general principles of management:

1. Avoid direct challenge of the patient's defenses, e.g. pushing him to "do better." Such methods lead to fear and thus to the intensification of the maladaptive pattern.
2. Avoid responses that the patient's behavior attempts to provoke, e.g. responding to hostile behavior with anger.
3. Attempt to recognize aspects of the patient's behavior that can be used constructively.
4. Use each patient's assets to help him experience successes.

The application of the general principles varies with each personality pattern. The schizoid patient's aloofness tends to provoke others into the same kind of behavior. This must be avoided and an attitude of friendly interest maintained. An asset possessed by such a patient, however, is his ability to work successfully at solitary tasks. Such tasks should be provided and appreciation given for each success.

The patient whose personality pattern is characterized by denial offers a major test of the skill of the rehabilitation worker. The hostile, suspicious behavior of such patients provokes negative reactions in others which in turn tend to perpetuate and intensify the difficult behavior. Such responses must be avoided if rehabilitation is to succeed. Such patients, however, possess a major asset in their intense drive to achieve. If the rehabilitation worker can avoid negative feelings on his own part and can direct the patient's activities into areas where success is possible, such success makes hostile and suspicious behavior on the part of the patient less necessary to him. In such a setting rehabilitation efforts can make progress.

The passive-dependent patient is ingratiatingly helpless and tends to stimulate "mothering" responses in others. Giving in to such responses, however, simply perpetuates the patient's difficulty in acting independently. From the point of view of rehabilitation success the asset to be worked with in such a patient is his desire to please. The rehabilitation worker should establish a friendly, accepting relationship, resist his "mothering" tendencies, and gently but firmly insist that the patient perform prescribed tasks. If this can be done these patients are likely to do well.

Little needs to be done psychologically for the patient whose personality pattern is that of sublimation. Such a patient tends to be well adjusted and to know how to direct his energies in a constructive fashion. He needs only medical help and occupational training to be a rehabilitation success. Such patients are a joy to work with and one can only wish that there were more of them.

Although much constructive attention to the emotional problems of the cerebral palsied patient can and should be given by the professional person working most closely with him, more specialized help is necessary in some cases. At the time of initial evaluation 41 per cent of the patients in this study were recommended for counselling or psychotherapy, but in only six to 10 per cent was skilled intensive therapy felt to be needed. A rehabilitation agency in this field needs a psychiatrist or experienced clinical psychologist to make evaluations and to provide treatment for those patients suffering from severe emotional illness. Other patients requiring special help can usually be handled by other members of the rehabilitation team under the supervision of the psychiatrist or psychologist.

Summary

This paper reports some of the results of a psychiatric investigation of 74 cerebral palsied adults who sought help at a rehabilitation center. Eighty-two per cent of these patients manifested emotional symptoms or problems of sufficient severity to interfere at least to some degree with rehabilitation efforts. Four different personality patterns could be reliably distinguished in this group: schizoid patterns, denial patterns, passive-dependent patterns, and sublimation patterns. Significant relationships were found between personality pattern and severity of emotional symptoms. Approaches to the

psychologic handling of such patients in a rehabilitation setting are suggested.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

VERY IMPORTANT

The next examinations, written and oral, of the American Board of Physical Medicine and Rehabilitation will be held in New York City, June 24 and 25, 1961. The final date for submitting application is February 15, 1961. Write to the Secretary, Dr. Earl C. Elkins, 200 First Street S. W., Rochester, Minnesota, for application.

Comparison of the Bactericidal Effect of Visible Light With Ultraviolet Light on Staphylococcus Aureus

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● It has been shown that long ultraviolet radiations (3000-3900 A.U.) have a bactericidal action on Mycobacterium tuberculosis (Segal & Bloch, 1955), and Escherichia coli (Luckiesh, 1947). However, this effect was not observed in the case of Staphylococcus aureus (Gates, 1930). The present study, using a high pressure mercury-xenon lamp demonstrates that not only is there a bactericidal action on Staphylococcus aureus with long ultraviolet radiations, but this effect is also observed with visible light, i.e., with a wavelength greater than 3900 A.U. This action seems to be dependent on the presence of oxygen, whereas the bactericidal action, due to wavelengths shorter than 3000 A.U. is independent of the presence of oxygen.

In January, 1955, Segal and Bloch[1] demonstrated that Mycobacterium tuberculosis was killed by light filtered through glass—i.e., with wavelengths longer than 3100 A.U. This effect had also been noted by Luckiesh[2] in irradiating Escherichia coli. However, this effect was not observed by either Gates,[3] or Browning and Russ[4] in the case of Staphylococcus aureus. These observers considered that 2960 A.U. was the longest wavelength which exerted any lethal effect on Staphylococcus aureus, and therefore no lethal effect could be expected when the light was filtered through ordinary window glass.

Some preliminary observations that I had made, suggested that this view was erroneous and that in fact, light filtered through glass did have a lethal effect on Staphylococcus aureus. These results, though in disagreement with Gates, and Browning and Russ, confirmed the pioneer work of Nils Finsen.[5] His experiments had led him to conclude that — firstly, most bacteria pathogenic to man were destroyed by the blue and violet rays of the spectrum, and secondly, that this action was dependent on the presence of oxygen.

Because of the current interest in Staphylococcus aureus by virtue of its acquired resistance to antibiotics and prevalence in hospital infections, and because of the possible applications of light therapy in the treatment of superficial infections, it was decided to reinvestigate the action of light on Staphylococcus aureus, to determine:

(a) Whether there was evidence of bactericidal action with wavelengths longer than 3100 A.U., and if so,

(b) Whether such action was dependent on the presence of oxygen.

Methods and Procedures

General Procedure: Staphylococcus aureus maintained under constant conditions of media and temperature, but in an atmosphere of either air or natural gas were irradiated by light from a high pressure mercury lamp. A different filter was placed between the light and the organisms in each of three series of experiments, to exclude different portions of the spectrum. The organisms were irradiated for periods of different duration, following which they were incubated for 24 hours and the results read. The time required to produce a bactericidal effect was recorded.

Details of Procedure

Organism, Culture, and Method of Making Test Plates: the Oxford staphylococcus was used in all experiments. This was grown in nutrient broth and subcultured every 24 hours. For pouring plates, the culture was diluted — 1 part to 500 of distilled water. This was poured over the surface of a nutrient agar plate, in a petri dish. The excess fluid was poured off; the plate dried for one hour in an incubator, and then stored in a refrigerator until ready for use.

Method of Maintaining Constant Temperature: the petri dish, with its cover

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Read at the 3rd International Congress of Physical Medicine, Session on Physistric Care Following Trauma, Washington, D. C., August 25, 1960.

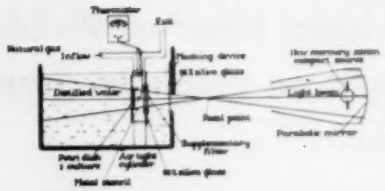

Fig. 1 — Experimental layout for irradiating organisms.

glass replaced by a metal stencil, was placed in a cylindrical metal container (fig. 1) so that the agar surface on which the organisms were seeded, was opposite a window of 96 per cent silica (ultraviolet transmitting) glass. Various filters could be placed in front of this window. To the front surface of the stencil, a thermistor was attached to permit recording of any temperature changes. (At no time did the temperature in the container exceed 37 C.) The entire metal container was air tight except for two apertures which permitted the passage of air or natural gas. The metal container was immersed in distilled water in a rectangular tank, one end of which was replaced by 96 per cent silica glass, and covered with a masking device.

Aerobic or Anaerobic Atmosphere: under usual circumstances, room air had free access to the organisms via the apertures in the metal container insuring normal aerobic conditions for irradiation. When anaerobic conditions were required, natural gas was passed for one hour (prior to and during irradiation), through the container containing the organisms. An indicator of leuco-methylene blue showed that there was, under these conditions, no free oxygen in the atmosphere surrounding the organisms.

Light Source: light from a one kilowatt high pressure mercury-xenon compact source (General Electric A16-H1000) was focussed by means of a 14" diameter parabolic rhodium plated reflector on to the organisms on the petri dish. (This lamp was loaned for this research by the Mayo Clinic through the kindness of Dr. Frank Krusen and Dr. E. J. Baldes.)

Filters: between the light source and the petri dish, there was a holder in which filters could be placed to intercept the light beam and so alter the quality of the light reaching the organisms. The following filters (fig. 2), all of which transmitted the entire visible spectrum, but each of which excluded a different portion of the ultraviolet spectrum were used:

1. Corning 96 per cent silica ultraviolet transmitting No. 9-54. This filter, 2.0 mm. thick, transmits 75 per cent of all visible and ultraviolet energy down to 2600 A.U. but less than 1 per cent of light energy below 2100 A.U., i.e., it transmits middle and long ultraviolet and visible light.

2. Window Glass. This filter, 1.0 mm. thick, transmits 75 per cent of all visible and ultraviolet energy down to 3400 A.U. but less than 1 per cent light energy shorter than 3000 A.U., i.e., it transmits long ultraviolet and visible light, but no middle ultraviolet.

3. Corning Noviol Shade 0, No. 3-75. This filter, 5.5 mm. thick, transmits 75 per cent of all visible light energy down to 5000 A.U. but less than 1 per cent light energy shorter than 3800 A.U., i.e., it transmits visible light, but no ultraviolet light.

Media Through Which Light Passes From Source to Organisms: the petri dish, metal container and the tank were so positioned that light from the mercury lamp passed through the following media before reaching the bacteria:

(1) Air.

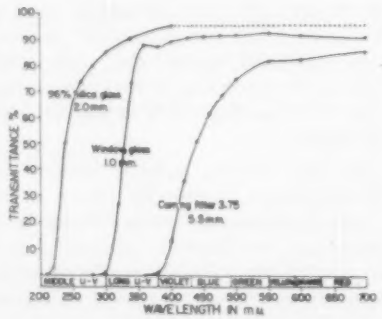

Fig. 2 — Transmittance characteristics of three filters.

(2) 96 per cent silica glass (on water tank).
(3) Distilled water (in water tank).
(4) Filter (on front of metal container).
(5) 96 per cent silica glass (on metal container).
(6) Air or natural gas.
(7) Organisms.

The duration of exposure of the plate could be altered by means of the masking device on the front of the tank.

End Point for Recording Results — Bactericidal Effect: for comparing results under different experimental conditions, the end point recorded was the irradiation time required to produce a bactericidal effect (fig. 3). This was defined as the shortest time exposure where 98 per cent of the organisms were killed in an irradiated area, as compared with a control area of the same size.

Results

Irradiation of Organisms Through 96 per cent Silica Glass. In 10 experiments (table 1) where organisms were irradiated through 96 per cent silica glass, the bactericidal effect occurred in 35 seconds at 350 cm's. from the focal point of the lamp. There was no detectable difference in the end-point for either aerobic or anaerobic conditions.

Irradiation of Organisms Through Window Glass. In nine experiments through window glass, at 35 cm's. from the focal point of the light source (i.e. — one tenth of the distance of the previous experiment), it required seven minutes exposure to produce a bactericidal effect in air — but under anaerobic conditions, it required 120 minutes exposure for the same effect.

Irradiation of Organisms Through Corning Glass No. 3-75. In five experiments through Corning glass No. 3-75, at the same distance as in the previous experiment (i.e. — 35 cm's. from the focal point of the light source), it required 110 mins. exposure to produce a bactericidal effect in air. Under anaerobic conditions, no bactericidal action was evident with exposures of up to four hours.

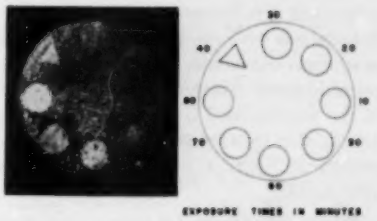

Fig. 3 — Irradiated test plate showing diminution in number of colonies in irradiated areas.

Discussion

Where the organisms are irradiated with the entire spectrum which is emitted by such a lamp, modified only by passage through water and 96 per cent silica glass (i.e. — middle and long ultraviolet, and visible spectrum), there is no difference whether the irradiation is under aerobic or anaerobic conditions. Also, the bactericidal effect is produced in a very short space of time (i.e. — 35 secs. at 350 cm's., from the focal point of the beam).

However, when the middle ultraviolet spectrum (i.e.—wavelengths shorter than 3100 A.U.) is eliminated by the transmission of the light through a glass filter, two major changes occur.

(1) *The time exposure is increased greatly.* To increase the time exposure for experimental purposes — the distance of the plate from the focal point of the beam was reduced to one tenth of that without the glass filter in the previous experiment (i.e. — from 350 cm's. to 35 cm's.). By application of the inverse square law, this is equivalent to an increase of the time exposure factor by approximately 100 times. Thus, under aerobic conditions it requires seven minutes at 35 cm's. to produce a bactericidal effect, while under similar conditions, but at 350 cm's. distance, as in the previous experiment, it would require approximately 700 minutes to produce the same effect.

(2) *Bactericidal action is decreased with lack of oxygen.* To produce a bactericidal effect under anaerobic conditions when irradiated through window glass, requires nearly 20 times as much exposure as under aerobic conditions.

Although it is known that the passage of natural gas over media in a closed system produces anaerobic conditions, there is possibly some dissolved oxygen remaining in the media, and if this could be eliminated, the time exposure to produce a bactericidal effect might be even more prolonged.

When the entire ultraviolet spectrum (i.e. — wavelengths shorter than 3800 A.U.) is eliminated by passing the light through Corning Filter No. 3-75, under aerobic conditions, the bactericidal effect takes more than 16 times as long (110 mins.) as under the same conditions, except through window glass (seven mins.). But under anaerobic conditions, following irradiation through Corning Filter No. 3-75, no effect was seen even after 240 minutes exposure. Longer time exposures were not tried because of technical difficulties.

In irradiating Escherichia coli, Luckiesh demonstrated (fig. 4) that the energy required to produce a bactericidal effect at 3000 A.U. was 10 times that needed for the same effect at 2600 A.U. However, to produce a bactericidal effect at 3500 A.U., required 100 times the energy needed for the same effect at 3000 A.U. The present findings indicate that the susceptibility of Staphylococcus aureus to the lethal effects of light is of the same order. In Gates' work, it is to be noted that he was using a monochromatic apparatus necessitating a 30 minute exposure to produce a bactericidal effect at 2960 A.U. Using such apparatus to produce the same effect at 3500 A.U. would have required an exposure time of 3000 minutes, and it is therefore understandable why radiations longer than 2960 A.U. were considered to have no bactericidal action.

In reviewing the literature one finds many apparently different results. But careful study usually reveals that light sources of differing spectral quality or intensity have been used and that when these are taken into account, differences in results can be explained. And it is clear that even today the importance of specifying the spectral quality and the energy (i.e. — intensity x time) used in such experiments is insufficiently appreciated. Once the germicidal effectiveness of different wavelengths is appreciated, one realizes that in absolute terms, it is not that long ultraviolet and near visible radiations are ineffective against Staphylococci and other pathogens, but that they appear ineffective compared with the extremely potent effect in the middle ultraviolet region.

Conclusions

From these results, it is evident that not only does light filtered through window glass exert a bactericidal action on Staphylococcus aureus, but this effect is also observed even after filtering out the entire ultraviolet spectrum. However, the energy required to produce a bactericidal effect with the long ultraviolet and visible spectrum is great, compared with wavelengths shorter than 3100 A.U.

In addition it is to be noted that bactericidal action with wavelengths shorter than 3100 A.U. appears to occur equally well under aerobic or anaerobic condi-

Table 1: Time Taken to Produce Bactericidal Effect with Filtered Light

Experiments		Filter	Distance of Organism from Focal Point	Time Exposure*	
				Air	Gas
10	.....	96% silica glass (entire spectrum)	350 cm.	35 sec.	35 sec.
9	.....	Window glass $\lambda > 300$ mμ.	35 cm. (350 cm.)	7 min. (700 min.)**	120 min. (12000 min.)**
5	.....	Corning glass 3-75 $\lambda > 380$ mμ.	35 cm.	110 min.	> 4 hrs.***

*Time exposure required to produce 98 per cent destruction in irradiated area under aerobic and anaerobic conditions.

**Figures calculated by use of inverse square law.

***Not determined because the excessive exposure required introduced other variables such as heat.

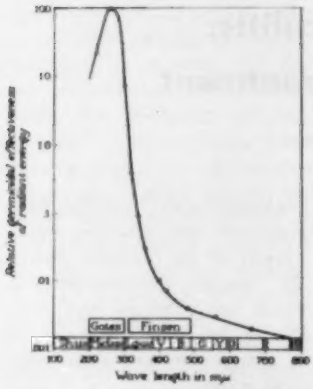

Fig. 4 — The relative germicidal effectiveness of radiant energy. (After Luckiesh)

tions, whereas, with wavelengths longer than 3100 A.U. anaerobic conditions markedly increase the exposure time required to produce a bactericidal effect.

These results only go to confirm the findings that Nils Finsen published over 50 years ago.

Acknowledgment: The author is grateful to Dr. Frank H. Krusen and Dr. Edward J. Baldes of the Mayo Clinic, Rochester, Minn. who encouraged me in this work and made available the special lamp used in these studies; and to the Poliomyelitis Foundation of Alberta, Canada for a grant towards this research and the McEachern Laboratory and Provincial Laboratory of the University of Alberta for providing laboratory space.

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Cervical Radiculitis: Diagnosis and Treatment

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Los Angeles

● The definition, diagnosis and method of treating cervical radiculitis are discussed. The objective of the active treatment program is to relieve the pain caused by nerve root compression by relaxing the cervical, scapular and shoulder musculature and by restoring a normal range of motion to the cervical spine. Specific modalities and specialized technics to achieve this objective are reported. Results of a study involving the response to treatment of 84 patients are given.

Cervical radiculitis is a symptom complex which may result from a number of conditions affecting the cervical spine, the cervical nerve roots, or the cervical nerves in and about the intervertebral foramina. By strict definition, however, cervical radiculitis is a painful state resulting from compression, stretching, or disease affecting one or more sensory roots and, with lesser frequency, the corresponding motor roots emanating from the cervical portion of the spinal cord. The most frequent cause of such root involvement is probably osteoarthritis or degenerative arthritis affecting the bony parts and associated articulations of the cervical spine. The degree of radiographically demonstrated involvement is not always indicative of the extent of nerve root compression and does not necessarily bear a direct relationship to the amount of nerve root irritation or to the severity of pain and/or paresthesia. It would appear, from the evidence accumulated, that the incident or activity responsible for precipitating the nerve root irritation is of greater importance than the degree of pathologic change in the skeletal parts.

Ruth Jackson[1] has elucidated the mechanism of cervical nerve root irritation in masterly fashion, and has enumerated the factors which may produce nerve root compression as follows:

1. Subluxations, produced by hyperextension or hyperflexion injuries which result in anteroposterior narrowing of the intervertebral foramina with pinching of the nerve root;
2. Foraminal spurs, resulting from degenerative changes occurring in the vicinity of the posterior facets and the lateral intervertebral joints, which are potential root compressors in the event of injury, direct or indirect, in and about the cervical spine;
3. Fractures of a posterior facet or a vertebral arch with resultant hemorrhage and swelling;
4. Cervical disc herniation and compression, believed to be rare in view of the anatomic placement of the lateral intervertebral synovial joints;
5. Other factors such as: (a) adhesions, resulting from trauma or inflammatory reaction, and producing fixation of the dural sheaths to the adjacent bony surfaces, and (b) congenital anomalies affecting the anatomic configuration of the articular processes and the foramina, and fusions of vertebral bodies with alterations in the mobility of the cervical spine.

Diagnosis

The diagnosis of cervical radiculitis is based upon an accurate history, a complete examination of the involved areas including a careful neurologic appraisal, cervical spine films, and, in selected cases, an electromyogram. In securing a history one must carefully elicit a full sequence of events concerning the patient's activities just before the onset of symptoms. This is especially important in those instances in which forceful or direct injury to the cervical spine has not occurred. In the present series most patients reported that a pre-

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cipitating stress or strain activity occurred prior to the onset of pain or discomfort. In a number of patients the activity involved unusual exertion or improper positioning, not ordinarily required in the individual's daily activities. Examples of such stress and strain phenomena include heavy and sudden lifting; pulling or pushing maneuvers; overhead activities with the neck in a hyperextended position, such as painting ceilings, replacing fixtures, cutting tree branches, and reaching overhead for objects; carrying weights, both animate and inanimate, on the shoulders or head, thus causing resistance to be placed against the cervical erector spinae muscles; minor blows either directly or indirectly jarring the cervical spine; and, occasionally, emotional trauma producing neck muscle spasm in a previously sensitized area. It is of considerable interest to note that in some cases the precipitating factor was so unobtrusive that the patient failed to recall or relate it to his problem until it was elicited and brought into proper perspective and sequence with respect to the onset of symptoms. In addition to immediate factors of stress, strain, or injury, a past history of cervical spine injury also was elicited in a high percentage of cases. Occupational activities also may be of importance and should be carefully explored.

The nature, frequency, duration, intensity, and distribution of the pain provides important information in arriving at a diagnosis. Characteristically, radicular pain follows a definite segmental distribution which may simultaneously involve areas of the neck, scapula, arm, forearm, and hand in a definite pattern. However, it is not uncommon to have involvement of only one or two areas widely separated from each other, such as the mid portion of the arm and the thumb in the distribution of the sixth cervical root. Occasionally pain may also be present in the antero-lateral chest and extend into the breast. Lancinating pain may occur with certain movements of the upper extremity and may interfere with sleep; in fact, night pain is usually more severe, more persistent, and less tolerable than diurnal pain or discomfort.

The examination involves a careful appraisal of the head and neck, the shoulder girdles, and the upper extremities. Range of motion of the neck and upper extremities is tested in all directions and its effect upon pain and pain distribution is evaluated. Areas of muscular atrophy and weakness must be detected by accurate observation, measurement, and muscle testing. Tenderness along the cervical erector spinae, trapezius, scalenus, scapular, and extremity musculature must be evaluated and recorded. Frequently, one may elicit tenderness along the cervical erector spinae muscle at a root level corresponding to the segmental distribution of the radicular pain and deep pressure at this point may aggravate or reproduce such pain. Isolated trigger points also may be detected in the scapular or interscapular muscles. Asymmetrical tightness or limitation of neck motion is also important in establishing muscular and ligamentous imbalance, which in itself may be a factor in producing or maintaining root compression. Neurologic evaluation for depression or absence of reflexes and for the determination of areas of hyperesthesia or hypesthesia must be performed carefully and with exactness. The correlation of motor and sensory changes with the x-ray findings is surprisingly high, especially when the sensory findings are consistent. Adjacent dermatomes are affected in many instances with corresponding areas of multiple involvement in the cervical spine as viewed on the radiographs. Infrequently, intermittent muscle fasciculations are evident and appear to be the result of root irritation and superimposed fatigue.

Radiographs of the cervical spine are essential for properly evaluating cervical radiculitis. In securing a cervical spine series it is important to request lateral views of the spine in the neutral, the flexed, and the extended position, as well as oblique views for the foramina and the interbody articulations. The nature of the cervical curve, the intervertebral disc spaces, the foramina and the mobility is thereby determined. Subluxations and, rarely, dislocations may thus be detected. The necessity for specialized x-ray views of the cervical spine has been stressed

by Abel,[2] and the extent to which structural injuries contribute to the development of subsequent changes in the cervical spine has been elaborated by Jackson[1, 3] and Abel.[4] The presence of hypertrophic and degenerative changes in the cervical spine is relatively high in the age group over 45 and tends to occur with greater frequency at the level of the fifth and sixth cervical vertebrae than elsewhere (table 1).

In the event that clinical examination reveals weakness and/or reflex changes an electromyogram is indicated. This serves to provide quantitative information about the degree of root or nerve involvement, and may be used as a prognostic as well as diagnostic tool when performed serially. From a diagnostic viewpoint the electromyogram will accurately locate the level of compression if root fibers have been destroyed and also will differentiate between root, plexus, or peripheral nerve involvement. The absence of positive findings also may serve to improve the prognosis and to make it possible for the physician to assure the patient that nerve destruction has not occurred. This may have psychologic value in providing objective data to reinforce the physician's clinical impression as a means of reassuring the patient.

Treatment

The relief of acute or chronic pain can be accomplished readily in almost all patients who present themselves with the condition diagnosed as cervical radiculitis. However, it is essential to the success of the treatment program to carefully orient the patient to his condition and to instruct him in great detail in the activities of daily living to be avoided during the course of active therapy. A majority of patients have attempted, either with or without supervision, to alleviate their distress with heat and medication, and some may have been given a trial of traction without benefit or, in some cases, with resultant increased discomfort. It is, therefore, of great importance to reassure the patient and to meticulously instruct him in the specific activities or postural attitudes to be avoided, as well as in those phases of home treatment required to supplement office treatment.

In most instances the patient does not recognize the aggravating factors of lifting and straining involved in housework, shopping, and other activities of daily living. Certain occupations which require the patient to assume long periods of static positioning of the head and neck, such as plumbing, carpentry, typing, and television repair may precipitate or aggravate the degree of pain and may prevent recovery. Sleeping in the prone position with the arms under the head or on a small pillow with the head and neck laterally flexed should also be discouraged. In women the hyperextended position of the neck during the hair washing procedure should be discouraged immediately. Exposure to sudden changes in temperature also should be avoided. In many instances recognition of these aggravating factors and their strict avoidance will result in

Table 1: Neuromuscular and Radiographic Changes

Weakness		Neurologic Changes		Radiographic Changes			
Muscle	No. Pts.	Reflexes — 1+ to 0	No. Pts.	Segment	Foraminal Spurring	Foraminal Narrowing	Disc Degeneration
Deltoid	5	Biceps	14	C3-C4	2	6	1
Biceps	4	Triceps	16	C4-C5	3	5	6
Triceps	6	Hypesthesia		C5-C6	27	23	30
Finger E.	4	Segment	No. Pts.	C6-C7	19	18	20
Opponens	1	C5	13	C7-T1	1	1	3
		C6	28				
		C7	23				
		C8	4				
		T1	1				

immediate relief of the acute pain. The effectiveness of the active program of therapy in relieving radicular pain is dependent upon proper orientation of the patient to the stressful factors just enumerated.

The objective of the active treatment program is to relieve the pain caused by nerve root compression by relaxing the cervical, scapular, and shoulder musculature and by restoring a normal range of motion to the cervical spine. To achieve this objective use is made of specific modalities and specialized technics. Relaxation of the musculature is achieved by the use of moist steam packs applied to the posterior neck and the shoulder girdle areas for 20 to 30 minutes, and is followed by deep heat in the form of microtherm therapy for 20 minutes. Relief of root compression pain, whether by edema or bony impingement, is aided by the application of ultrasound to the posterior neck and suprascapular region for five to 10 minutes at an intensity of 0.75 to 0.9 watts/cm.[2] Stretching of the ligamentous, capsular, and muscular tissues has been achieved in a majority of the patients reported in this series by manual mobilization of the neck and by rhythmic stabilization[5] applied to combined rotation and flexion positions of the head and neck. This form of treatment has been uniformly effective in rapidly relieving extremity pain and in providing an increased, comfortable range of neck motion. Medication is extremely useful in the early stage of the treatment program to provide an increased degree of muscular and general relaxation, to relieve acute pain, and to permit more effective patient cooperation in active treatment. Many muscle relaxant preparations are available for this purpose, although meprobamate and parafon have been most useful in my practice. The use of five or 10 grains of one of the salicylate preparations in combination with the muscle relaxant drug generally obviates the need for more potent analgesics. Medication is taken four times a day with reduction occurring coincident with the patient's improvement. In the majority of patients referred to my care prior treatment with medication given alone or in combination with heat and/or traction failed to achieve relief of pain. It would appear, therefore, that the other aspects of the treatment program are important in the over-all management of resistant cases of cervical radiculitis. In addition to the active treatment all patients who complain of persistent paresthesia are given intramuscular B_{12} in 1,000 microgram doses three to five times a week. In my experience patients given B_{12} respond more quickly than patients who do not receive B_{12}. The value of B_{12} in hastening the rate of recovery from nerve root irritation is still uncertain, but its use for this purpose is widespread and has been advocated by Jackson.[1]

A program of home treatment to supplement office treatment consists of the use of moist heat to the posterior neck twice or three times daily, neck rotation exercises performed very gently and slowly with the head in mild flexion four times daily, and the use of an inclined pillow for sleep to maintain the head in a relatively straight plane with respect to the dorsal spine. Avoidance of all lifting and straining activities and hyperextension movements of the head is recommended until complete relief has been obtained. A gradual return to necessary activities involving lifting and straining is permitted after alleviation of pain and following proper instruction in the method of performing such movements. In the presence of foraminal spurring or narrowing the patient is cautioned against hyperextending the neck at any time as a prophylactic measure to prevent recurrences.

Statistics and Results

The results of this study include 84 patients — 45 females and 39 males, ranging in age from 21 to more than 70 years. The majority (53) were in the age group from 40 to 60 years (table 2). Prior treatment had been received elsewhere in 49 cases, or over half the total number of patients. Of these 43 were only slightly improved or unimproved, and nine stated that they were made worse by the treatment.

On the basis of the intensity, duration, and the absence or presence of night pain

the patients were divided into four categories: mild or 1+, moderate or 2+, moderately severe or 3+, and severe or 4+. Three patients were classified as 1+, 34 patients as 2+, 44 as 3+, and three as 4+ with respect to subjective pain. The pain had been present, in varying degrees, for a minimum of one day to a maximum of three years with the largest single group of patients in the one to two month category (table 3).

Thirty percent of all patients in this series gave a history of a prior automobile accident, in most instances many years before the onset of radicular pain.

Neurologically, reflex changes were found in 30 patients and sensory changes in 73 patients. The biceps reflex was diminished to absent in 14 cases, the triceps reflex in 16 cases. Hypesthesia was the most common sensory deficit with 64 patients (80 per cent) demonstrating hypesthesia in either the fifth, sixth or seventh cervical nerve dermatome, and the majority (60 per cent) in the sixth or seventh cervical nerve dermatome. Muscle weakness was found in 22 patients with involvement of the deltoid, biceps, triceps, and finger extensors accounting for 19 of these cases.

Thirteen electromyograms were performed with positive findings demonstrated in nine patients. A single nerve root was involved in five cases and two nerve roots in four cases. The fifth, sixth and seventh cervical nerve roots were involved in 10 instances and the eighth cervical nerve root in three instances. The seventh cervical nerve root was involved most frequently.

Radiographic findings correlated well with the clinical evaluation and impression. Disc space narrowing or degeneration was present in 60 patients, foraminal spurring in 52 patients, and narrowing in 51 patients. The fifth and sixth cervical vertebrae interspace and corresponding foramen was the site of the most frequent involvement followed closely by the sixth and seventh cervical vertebrae interspace and foramen (table 1). Thus, the neurologic, electromyographic, and radiographic findings exhibit a high degree of correlation.

Table 2: Distribution of Age and Sex

Age	Males	Females
Under 40	5	5
40-49	18	18
50-59	8	9
60-69	8	7
Over 70	—	6

The response to treatment was recorded as follows: (1) poor — no relief; (2) fair — mild, intermittent pain; (3) good — mild, intermittent discomfort without pain; and (4) excellent — complete relief of pain. On the basis of this scale 40 patients had an excellent response, 36 a good response, six a fair response, and two a poor response to treatment.

In the group of nine patients with positive electromyographic findings, six with moderately severe pain (3+), two with moderate pain (2+), and one with mild pain (1+), the response to treatment was excellent in six, good in two, and fair in one.

The total number of treatments required varied from one to 30; the distribution, however, shows that 60 patients of the 84 treated required one to 10 treatments (table 3).

Case Histories

E. D., a 51-year old male, employed as a grocery clerk and required to lift weights of 40 to 50 pounds, was referred with the complaint of pain in the right shoulder and arm and numbness and weakness in the right hand of two weeks duration. Heat and medication had been used with no relief. Past history revealed that the patient had been involved in two rear-end auto collisions approximately four and five years ago. Neuromuscular examination revealed weakness in the scapular muscles, the deltoid, biceps, brachioradialis, wrist extensors, finger extensors, and opponens pollicis. The biceps and triceps reflexes were diminished and hypesthesia was present in the distribution of the fifth, sixth and seventh cervical nerve dermatomes. Radiographs revealed a reversal of the cervical curve and moderately severe hypertrophic and degenerative arthritic changes involving the fourth and fifth,

Table 3: Treatment Data and Response

Time Lapse from Onset to First Treatment		Total Treatments Required		Results of Treatment	
Days	No. Pts.	No. Rxs	No. Pts.	Response	No. Pts.
1-15	18	1- 5	27	Excellent	40
16-23	7	6-10	33	Good	36
24-31	4	11-15	13	Fair	6
Mos.		16-20	9	Poor	2
1- 2	22	21-25	1		
2- 4	15	26-30	1		
4- 6	4				
6-12	4				
13-36	10				

fifth and sixth, and sixth and seventh cervical vertebrae interspaces and right neural foramina. Electromyographically, extensive polyphasic motor unit activity was found in the muscles supplied by the anterior and posterior primary rami of the fifth, sixth and seventh cervical nerve roots on the right. This patient received a total of 19 treatments given three times weekly and became asymptomatic. A supplemental home program was established during the course of office treatment and the patient refrained from lifting activities for a period of six weeks. He was still asymptomatic when seen one year later.

I. R., a 54-year old male, was referred with complaint of persistent pain in the left arm and hand of two months duration. The pain occurred following a period of fairly intensive pruning of trees with heavy shears. Prior treatment had been given in the form of heat and cervical traction twice daily for five to six weeks without any relief. When it was recommended that he be hospitalized for cervical traction with skull tongs, the patient refused, and he was subsequently referred to my care. Examination revealed movements of the head and neck in rotation and extension to aggravate the pain and numbness in the extremity. There was weakness of the left triceps and the wrist extensors. The triceps reflex was markedly diminished. Radiographs revealed extensive encroachment by bony spurs upon the neural foramina of the fifth and sixth and the sixth and seventh cervical vertebrae. The electromyogram showed fibrillation of denervation potentials in the wrist extensors, triceps, opponens pollicis and flexor carpi ulnaris. Intensive treatment was initiated, including manual mobilization, B_{12} injections, medication, and a supplemental home program. Following 10 treatments the patient had complete resolution of pain. He was seen two and one-half years later when he brought his wife in for examination and at that time denied any recurrence of pain. Neuromuscular examination revealed complete recovery of muscle strength and reflex activity.

Discussion

As a clinical entity cervical radiculitis is encountered fairly often in the practice of physical medicine. It may be precipitated in many ways but the basic cervical spine and adjacent tissue pathology is essentially the same. To the patient the major problem is that of pain relief, for, in many instances, the persistent numbness, tingling, and lancinating pain interferes with the patient's sleep, his work, and his social activities. His irritability is matched only by his frustration in failing to understand the origin and distribution of the discomfort. Although a variety of approaches have been used in the treatment of this condition, the program outlined in the preceding pages has been extremely effective in relieving the pain, in restoring mental and physical mobility, and in minimizing or completely eliminating recurrences. The method is applicable to all cases of cervical radiculitis, excluding malignancies, irrespective of the precipitating

factor or factors, the acuteness or chronicity of the condition, and, within limits, the age of the patient.

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The 1962 meeting will be held in St. Louis at the Chase and Park Plaza Hotels, November 9-11.

The Effect of Weight Bearing Exercise on Radioactive Sodium Clearance from Normal and Osteoarthritis Knee Joints

Lawrence H. Wisham, M.D.
Selvan Davison, M.D.
and
Leonard Gordon, M.D.
New York

● As part of a continuing study into the circulatory physiology of the knee joint the authors have found that mild exercise and also the administration of intra-arterial Priscoline brings pain relief in the osteoarthritic knee. Their studies have shown that both procedures have the effect of decreasing Na^{24} clearance from the knee joint. The clearance rate indicates the proportional removal per minute. In the present study the normal group average clearance from the knee joint shows a highly significant response to very mild weight bearing muscular effort during exercise. The clearance rate then very rapidly returns to the resting clearance levels when exercise stops. The statistical significance is determined of differences between the average clearances of rest, during, and after exercise for normal subjects and osteoarthritic subjects.

Patients who have degenerative joint disease very often have partial or complete relief of pain after walking a few minutes. Such a desirable effect might be associated with an increased blood flow to the affected joint. We recently reported[1] that a vasodilating substance administered intra-arterially resulted in no change or a decrease in blood flow within the osteoarthritic knee. It was felt that a similar investigation of the effect of exercise on radioactive sodium clearance, and presumably, blood flow from the knee joint, was indicated.

Method

All subjects rested in the supine position for a 20 to 30 minute period prior to the beginning of the experiment. The knee joint was then entered with a 1.5 inch 20 gauge needle and 0.1 cc. of isotonic radioactive sodium chloride solution, containing one to three microcuries of Na^{24}, was injected. A light weight Geiger counter was then strapped over the side of the knee opposite to the area of injection. The radioactivity present under the counter was recorded on an automatic register at one minute intervals. After six to eight minutes the subject was asked to rise and walk up and down the room with the Geiger counter still in place. After six minutes of walking the subject again rested for six to eight minutes; during the entire procedure the radioactivity present was recorded at one minute intervals. In eight of the 17 patients we tested, the same procedure was followed except that we did not monitor the radioactivity present during the walking phase of the experiment.

The clearance half life (the time taken for the activity initially present to be reduced to one-half) was found by plotting the data on semilogarithmic graph paper. The clearance constant (K) was calculated from the clearance half life from the formula: K equals natural logarithm of two divided by the half life in minutes. (The clearance rate indicates the proportional removal per minute and is indicated by a constant figure. This clearance constant is derived from the formula given below. The clearance constant means also the constant proportional removal of radioactive material per minute but is given in minutes to the minus one, since it is a reciprocal. The clearance rate is expressed as a half life in minutes.) In earlier reports[2] we determined standard deviation based on three studies of Na^{24} clearance from the same area in the same individual; two subsequent studies of the individual fell within the range of the average plus or minus twice the standard deviation. We also found that if a plus or minus 20 per cent error was arbitrarily assigned to a Na^{24} clearance determination, subsequent determinations from the same

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area of the same individual would fall within the range so established. We therefore consider any change in the clearance constant following a change in the environment such as exercise, or the administration of a drug, less than 20 per cent, not to be significant.

In the present study we determined the statistical significance of differences between the average clearances at rest, during, and after exercise, for the normal subjects and the osteoarthritic subjects. This was determined after finding the standard deviation of each group and comparing the observed differences to the standard error of the difference of the two groups. The formula being:

$$\sigma\Delta = \sqrt{\frac{(\sigma_1)^2}{N_1-1} + \frac{(\sigma_2)^2}{N_2-1}}$$

where $\sigma\Delta$ is the standard error of the difference, σ is the standard deviation and N is the number of observations. The chances of the differences between the groups being on a random basis were then expressed in odds.

Studies were made in 13 normal subjects who were between the ages of 26 and 41, and in 17 patients from the Arthritis Clinic, all of whom had by x-ray, degenerative knee joint disease. This latter group varied in age from 52 to 84.

Results

The clearance rates at rest for 13 normal subjects were determined. The most rapid rate was 0.0454 minutes^{-1}; and the slowest 0.0216 minutes^{-1}. The average was 0.0349 minutes^{-1}. If we consider that a plus or minus 20 per cent change in the clearance rate during, and immediately after exercise, is clinically an insignificant change, 10 of the subjects showed a significant increase in rate of clearance, one showed an insignificant increase, and two showed an insignificant decrease in clearance (table 1).

The average clearance for this group of normal subjects during exercise was 0.0646 minutes^{-1}, which represents 84.9 per cent increase in clearance as compared with the average resting clearance rate. The T value for the mean differences between resting and during exercise clearance rates was 3.12; $0.01 > P < 0.001$, which is statistically significant. Expressed in odds, the chances that this difference is not on a random basis is 515 to 1.

Immediately after exercise, the clearance rates as compared with the resting clearance rate showed that five still had a significant increase, three an insignificant increase, one an insignificant decrease, three a significant decrease and one showed no change (table 2). The average clearance rate after exercise was

Table 1: Normals — Exercise, Clearance Constant (K) Minutes^{-1}

Patient	Age (Years)	Rest Clearance	During Exercise Clearance	Per Cent Change	After Exercise Clearance	Per Cent Change
J.M.	27	.0294	.0560	+90.5	.0213	−27.6
J.P.	37	.0334	.0416	+24.9	.0209	−37.3
W.B.	29	.0454	.0660	+45.6	.0674	+48.4
J.N.	37	.0413	.1540	+273.0	.0674	+63.0
D.C.	37	.0355	.0385	+8.4	.0381	+7.3
R.E.	41	.0413	.1260	+205.0	.0674	+63.0
A.B.	31	.0272	.0447	+64.4	.0265	−1.7
J.S.	25	.0447	.0924	+103.4	.0523	+17.0
R.D.	40	.0307	.0301	−2.0	.0213	−31.7
W.B.	31	.0374	.0364	−2.5	.0425	+13.8
A.R.	26	.0307	.0396	+29.0	.0307	0.0
J.C.	40	.0350	.0660	+88.6	.0532	+52.0
E.Q.	31	.0216	.0477	+122.0	.0239	+10.8
Average		.0349	.0646		.0409	
Average Per Cent of Change				+85.1		+17.0

Table 2: Osteoarthritics – Exercise, Clearance Constant (K) Minutes^{-1}

Patient	Age (Years)	Rest Clearance	During Exercise Clearance	Per Cent Change	After Exercise Clearance	Per Cent Change
A.M.	65	.1120	.0578	—48.4	.0578	—48.4
A.N.	68	.0455	.0693	+52.1	.0332	—27.1
L.G.	76	.0612	.0565	+7.6	.0184	—70.2
I.H.	75	.0536	.0489	—9.0	.0315	—41.3
R.C.	72	.0278	.0513	+84.1	.0278	0.0
S.K.	66	.0714	.1210	+69.0	.0220	—69.2
M.B.	78	.0815	.0693	—15.0	.0532	—34.7
M.L.	63	.1030	.1060	+2.9	.1110	+7.9
B.S.	67	.0858	.0416	—51.4	.0554	—35.5
O.J.	52	.1060			.0578	—45.1
F.L.	66	.0830			.0416	—49.8
R.T.	74	.0730			.0272	—62.7
A.W.	84	.0693			.0413	—40.4
K.P.	73	.0364			.0364	0.0
B.C.	77	.0602			.0577	—4.2
M.Z.	64	.0631			.0675	+6.9
A.S.	72	.0554			.0554	0.0
Average		.0681	.0690		.0468	
Average Per Cent of Change				—3.1		—31.1

0.0409 minutes^{-1} which is a 17 per cent increase as compared with the average for the resting clearance rate. The T value was 1.63, $0.2 > P < 0.1$ which is not statistically significant. Again if expressed in odds, the chances that the difference is not on a random basis is only eight to one.

In the 17 patients with osteoarthritis, confirmed by roentgen findings, the clearance rates during exercise were determined in nine, and in all subjects clearance rates were taken before and after exercise. The mean clearance at rest was 0.0681 minutes^{-1}. The mean resting clearance for the nine patients who had clearance determinations during exercise was 0.0713 minutes^{-1} and the mean for these patients during exercise was 0.0690 which is a drop of the mean clearance rate of 3.1 per cent. In this group two showed clinically significant decreases, two showed insignificant decreases, two showed insignificant increases, and three showed significant increases in their clearance rates. Statistical analysis showed no significant difference between the mean clearance at rest and during exercise. The mean clearance for all of the patients immediately following exercise was 0.0468 minutes^{-1} which is slowing of the mean clearance rate of 31.1 per cent. Eleven demonstrated a significant decrease, one showed an insignificant increase, three showed no change, and two showed significant increases in their clearance rates. T value for the difference of the means at rest and after exercise was 4.6, $P > 0.001$ which is statistically highly significant. The odds that this observed difference is not on a random basis are 50.000 to 1.

Discussion

In a previous study, we found that normal knees responded to the intra-arterial injection of a vasodilatating drug (Priscoline) by showing an increase in the clearance constant and the osteoarthritic knees which had a clearance rate much faster than the normal knees at rest, showed no response or even a slowing of the clearance of Na^{24} following intra-arterial Priscoline. The present study confirms the difference between the resting clearance rates in the normal and osteoarthritic knee. It also supports our original hypothesis, expressed in the earlier paper, that there is a marked degree of dilatation of capillaries in the osteoarthritic knee and that any procedure which causes vasodilatation of

capillaries in the skin and muscle about the knee, e.g. exercise, will not result in any further vasodilatation of capillaries within the knee joint, since they are already maximally dilatated.

In the present study, the normal group average clearance from the knee joint shows a highly significant response to very mild weight bearing muscular effort during the exercise. The clearance rate then very rapidly returns to the resting clearance levels when exercise stops. We assume that the increase within the joint during exercise, results as a by-product of the increased blood flow to the muscles around the knee joint during the exercise, probably as a result of an increase in cardiac rate and stroke volume. In the osteoarthritic patients however, during exercise there is a small, statistically not significant decrease in Na^{24} clearance and presumably therefore an insignificant decrease in blood flow. Furthermore, after exercise stops, there is a significant drop in Na^{24} clearance as compared to the pre-exercise clearance rate. We interpret this finding to indicate that the capillaries in the osteoarthritic knee are fully dilated, and that the increase in blood flow to the muscles around the knee during exercise, with the consequent increase in pulse rate and stroke volume can have little or no effect on the already maximally dilated capillaries within the knee joint; in fact, when exercise ceases, blood flow to the osteoarthritic knee is less than the resting level probably because capillaries within the muscle remain dilated, until oxygen debt no longer exists.

Mild exercise very often gives a temporary, partial or even complete relief of pain in the osteoarthritic knee. A similar relief of pain is affected by the administration of intra-arterial Priscoline. Since our studies have shown that both procedures have the effect of decreasing Na^{24} clearance from the knee joint and presumably resulting in a diminution of blood flow, we are considering the possibility that the amount of blood flow in the knee joint and the pain present are related. We intend to continue our studies into the circulatory physiology of the knee joint.

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2. Wisham, L. H.; Yalow, R. S., and Freund, A. J.: Consistency of Clearance of Radioactive Sodium from Human Muscle. Am. Heart. J. 41:810 (June) 1951.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Effects of Combined Denervation and Tenotomy on Skeletal Muscle

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● In adult albino rats a comparative study was made of the effects of tenotomy, denervation, and the combination of the two on the work output, endurance, and weight of the skeletal muscles attached to the tendo achillis. Denervation was achieved by high excision of the sciatic and femoral nerves at the base of the thigh. Tenotomy was effected by severance of the tendo achillis with overlap and suture of the cut end to prevent reinsertion to the os calcis. Four weeks after tenotomy and denervation the work output and weight were determined and compared with the same factors as derived from normal muscles. The muscle weights and the initial and total work output were reduced most severely by combined denervation and tenotomy. Denervation alone caused more reduction in muscle weight and in work output than did tenotomy alone. The average work output of the gastrocnemius muscle group in gram meters per 100 seconds was 196 for the normal muscles, 108 for those tenotomized, 24 for those denervated and 12 for those both denervated and tenotomized. Evidently the combination of tenotomy and denervation of the same muscle group has a practically additive effect on the muscles, causing a very marked reduction in muscle weight and in work output and endurance.

In a previous study[1] we compared the effects of tenotomy and of denervation on the work output, endurance, and weight of the skeletal muscles in a large group of albino rats. Severance of the tendo achillis led to gradual reduction in the work output and endurance of the gastrocnemius-soleus-plantaris muscles for a period of up to 30 days; however, as a result of reattachment of the severed tendon a progressive return toward normal function occurred thereafter. Complete denervation by high excision of sciatic and femoral nerves led to marked reduction in work output and endurance and severe loss in weight of the muscles involved. The effects of denervation were more severe than those of tenotomy.

Upon noting this consistent difference we decided to determine the effects of combined denervation and tenotomy of the same muscles and compare the work output, endurance, and weights of these muscles with those denervated only, those tenotomized only, and the normal intact muscles of the contralateral limbs or of the corresponding limb in litter mates.

Materials and Methods

Litters of adult albino rats weighing about 200 gm. were divided into four groups. The first group was subjected to combined denervation and tenotomy, the second to denervation only, and the third to tenotomy only, while the fourth group was left intact as normal controls. Tenotomy and denervation were accomplished under ether anesthesia in the following manner. Tenotomy was performed on the left hind limb by complete severance of the tendo achillis from the os calcis. To prevent reattachment during the period of observation, the tendon was turned on itself after severance and sutured double with black silk. Denervation was accomplished by high excision of long segments of the sciatic and femoral nerves at the base of the thigh — the femoral nerve in the groin and the sciatic at the level of the greater trochanter of the femur.

Work output and endurance were determined on all animals approximately

Professor of Physiology, Mayo Clinic.

Table 1: Work Output of Skeletal Muscles After Denervation and Tenotomy

Status	Days p.o.	Rats in group	100-second observations in group	Average work output, gram-meters: First 100 seconds	Second 100 seconds	Third 100 seconds	All observation periods
Denervated and tenotomized	28	39	23	30±3.1*	15±2.1	13±2.03	12
Denervated	30	32	180	83±5.6	33±3.03	31±3.01	24
Tenotomized	28	43	23	149±4.4	100±3.7	105±4	108
Normal	29	33	118	236±7.2	176±7.8	185±8.7	196

*Average ± S.E.

Read at the 3rd International Congress of Physical Medicine, Session on Diseases of Skeletal Muscle, Washington, D. C., August 23, 1960.

Table 2: Weight of Skeletal Muscles After Denervation and Tenotomy

Status	Body weight, gm.	Muscle weight, mg.					
		Operated side			Normal side		
		Gastroc.	Ant. tibial	Plantaris	Gastroc.	Ant. tibial	Plantaris
Denervated and tenotomized	285± 5.98*	433±37.3	149±14.3	87±7.5	1384±30.2	502± 8.2	288± 2.4
Denervated	292± 8.9	519±20.5	161± 8.4	125±6.4	1438±27.5	518± 6.3	304± 3.9
Tenotomized	300± 4.9	1248±25.4	456± 8.3	242±5.6	1491±24.9	533± 9.4	319± 5.5
Normal	372±15.6				2284±78.2	714±36.5	498±26.9

*Average ± S.E.

30 days after operation. For testing, anesthesia was produced by giving pentobarbital sodium (nembutal) intraperitoneally, 25 mg. per kg. of body weight. The achilles tendon was exposed and isolated, and a 100-gm. weight was suspended from its free end by a wire that passed around a tallying pulley.[2] The work output was determined by stimulating the muscles optimally with an electric current introduced once every three seconds, and work output in gram-meters was recorded every 100 seconds.

At the end of the work-output test the animals were killed and their body weight and the weights of the individual muscles were recorded.

Results

A comparative analysis of the data in the tables (1 and 2) reveal that the most severe effect on the work output, endurance, and weight of the muscles results from the combination of denervation and tenotomy. The denervated muscles had more severe reduction in work output, endurance, and weight than those that were only tenotomized. Evidently tenotomy, although it does have effect, is not so damaging to the muscles as denervation. Expressed in gram-meters per 100 seconds, the average work output of the tenotomized and denervated muscles (gastrocnemius-soleus-plantaris) was 12, that of those only denervated was 24, that of those only tenotomized was 108, and that of the intact muscles in the control group was 196. Similarly the reduction in weight of the individual muscles at the end of the period of observation was most severe in the instances of combined tenotomy and denervation, and more severe in those only denervated than in those only tenotomized.

Comment

From a previous study[1] we had learned that between the fifteenth and thirtieth days after tenotomy the muscle's capacity to do work reaches its lowest. This was our reason for choosing the thirtieth postoperative day in this study as the approximate time for comparing the several groups in respect to work output and weight.

We had learned also that in about 60 days after tenotomy the muscles regain almost full strength. Knowlton and Hines[3] suggested that reattachment of the tendon occurs in about two weeks after tenotomy. In our investigation it occurred much later. However, the spontaneous reattachment of tendons after severance is amazingly frequent. It is being investigated thoroughly as to both rate and completeness, and a report will be made in due time. Evidently the elimination of tension and stretch of a muscle by tenotomy brings about a reduction in its weight and in its capacity to do work; but that reduction is more marked after denervation than after tenotomy, and is most marked after combined denervation and tenotomy. The trophic status of the muscle is most severely disturbed and the circulation and nutrition become most inefficient when the tendon and the nerves of the muscle are excised at the same time. We do not know the reason for the greater severity of effect of combined denervation and tenotomy obtained in our study.

Summary

In adult albino rats a comparative study was made of the effects of tenotomy, denervation, and the combination of the two on the work output, endurance, and weight of the skeletal muscles

attached to the tendo achillis. Denervation was achieved by high excision of the sciatic and femoral nerves at the base of the thigh. Tenotomy was effected by severance of the tendo achillis with overlap and suture of the cut end to prevent reinsertion to the os calcis.

Four weeks after tenotomy and denervation the work output and weight were determined and compared with the same factors as derived from normal muscles. The muscle weights and the initial and total work output were reduced most severely by combined denervation and tenotomy. Denervation alone caused more reduction in muscle weight and in work output than did tenotomy alone. The average work output of the gastrocnemius muscle group in grammeters per 100 seconds was 196 for the normal muscles, 108 for those tenotomized, 24 for those denervated and 12 for those both denervated and tenotomized. Evidently the combination of tenotomy and denervation of the same muscle group has a practically additive effect on the muscles, causing a very marked reduction in muscle weight and in work output and endurance.

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3. Knowlton, G. C., and Hines, H. M.: Effects of Growth and Atrophy Upon Strength of Skeletal Muscle. Am. J. Physiol. **128**:521 (Feb.) 1940.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

editorial

The White House Conference on Aging

The long planned White House Conference on Aging will be held in Washington, D. C. from January 9 to 12, 1961. The purpose of this conference is to create an environment in which our senior citizens may enjoy maximum opportunity to live productive and settling lives. It will provide means to assist them to meet their health needs, engage in gainful employment and to participate in family and community life as self-respecting citizens.

The American Congress of Physical Medicine and Rehabilitation is one of the national organizations that has been invited to name a representative to participate.

An Act of Congress has made this important conference possible and it directs that the Secretary of Health, Education and Welfare organize the meeting. President Eisenhower has appointed a Federal Commission concerned with aging which is composed of Cabinet level representatives along with certain local and state government officials and private groups which have special interest in the field.

Among the subjects to be considered at the conference are matters of housing, prevention of disability and development of research to delay the onset of long-term illness. Another goal, when possible, is to relieve old age of its burden of sickness in both the physical and mental spheres.

During the first fifty years of the Twentieth Century the number of persons in the age group from forty-five to sixty-four in the United States has tripled to thirty million people. During the same period the number of people who are sixty-five and over has increased to twelve million.

Numerous specialists and leaders in many disciplines have been devoting their talents to preparations for the conference. There are twenty subject matter areas, each with highly competent planning committees. Among these areas are population trends, income maintenance, inflation, retirement, health and medical care, rehabilitation, housing, education and religion.

The presence of a representative from the American Congress of Physical Medicine and Rehabilitation at the conference is recognition of the status of the physiatrist as a specialist in medical practice. The background paper on rehabilitation in an introductory note states: "Physical and mental health is one of the major concerns of middle-aged

and older persons. The care they receive in hospitals or other institutions is often custodial rather than rehabilitative. As a result several million of our older citizens are dependent almost solely on others for their support and for meeting the normal demands of daily living." Physiatric Medicine has much to offer this group to live in greater independence and with greater dignity. The Physiatrist must continually strive to improve his practice and must develop methods of training other physicians, particularly in general practice, to use the technics of his specialty.

We realize that age does not in itself cause illness and disability. It is a fact, however, that certain chronic illnesses and the handicaps that result are more prevalent among older people than they are among their younger associates. The Physiatrist is challenged to make available the benefits of his specialty to those who need this service and yet are sometimes not aware of its existence. Older people who are sick are frequently unable to withstand the expense that is associated with long periods of hospitalization and illness. Physicians must be deeply concerned with the economic aspects of medical care. They must arrange for the establishment of complete rehabilitation services as a component part of the medical care that is available to their patients. We must develop increased interest and leadership to re-establish the family as the unit of social life and to offer necessary assistance to those who need it.

The White House Conference on Aging will offer every American and every organization an opportunity to think, speak and act in the interest of all of us as we grow older. The task is truly of great magnitude but our best efforts will justify the wisdom of Robert Browning who said:

"Grow old along with me!
The best is yet to be,
The last of life, for which
the first was made."

— Charles D. Shields, M.D.

Dr. Shields, Georgetown University Hospital, 3800 Reservoir Rd., N. W., Washington, D. C., was recently appointed official delegate to the White House Conference on Aging by the Board of Governors of the American Congress of Physical Medicine and Rehabilitation. He welcomes suggestions from any of our members concerning matters which might be presented for discussion at this meeting. He would like to be informed of any ideas you might have concerning the role of our organization in this most important field.

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All original articles published in the January through December, 1960 issues are abstracted in this index. See page 628.

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This is a subject index and one should, therefore, look for the subject word, with the following exceptions: "Book Reviews," "Deaths," and "Survey of Selected Literature," are indexed under these titles at the end of the letters "B," "D" and "S." The name of the author, in brackets, follows the subject entry. If there are more than two authors, only the name of the first author is given.

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If a man does not keep pace with his companions,

perhaps it is because he hears a different drummer.

— THOREAU

ABSTRACTS

The following abstracted articles have been published in the January-December, 1960 issues of the journal.

JANUARY

Neurosurgical Relief of Intention Tremor Due to Cerebellar Disease and Multiple Sclerosis. I. S. Cooper. *(pp.1-4)*

● Intention tremor may be relieved by chemothalamectomy. The lesion produced is in the medial portion of the ventrolateral nucleus of the thalamus. This lesion apparently interrupts nerve fibers entering the thalamus from the globus pallidus, red nucleus, cerebellum, and probably also the vestibular nucleus. Relief of intention tremor has been maintained for as long as one year. Moreover, intention tremors of such varying etiology as familial cerebellar degeneration, severe intracranial trauma, toxic hepatocerebral disease, and multiple sclerosis have been alleviated by this procedure.

Requests for reprints and/or information should be directed to: Irving S. Cooper, M.D., 50 Sutton Place, New York 22, N. Y.

Survey of Recent Research Activities in the Rheumatic Diseases. R. L. Black. *(pp. 5-9; 2 figures)*

● Research in the rheumatic diseases has shown a remarkable growth curve over the past decade. This has been in part due to the stimulation furnished by the discovery of the remarkable effects of corticosteroids in these diseases, and in part due to the increasingly generous financial and other support furnished to investigators in this area of research by private and federal sources. For example, NIAMD support for research in this field increased from 48 projects in 1953 to 87 in 1956. Having equal importance with the increase in volume, the nature of research endeavor has shown a more sophisticated trend. Whereas in 1953 only 20 per cent of the activity was in the biochemical area; in 1956, 40 per cent of the projects were fundamentally of biochemical nature. Current research activity can be easily appreciated by a searching glance at the programs of the two American Rheumatism Association meetings held within the past year. In all, 70 papers were presented, 22 of which were devoted to a study of the fundamental properties of the protein substances present in some sera responsible for the production of positive lupus erythematosus, and rheumatoid factor tests. Another 30 per cent of these papers were devoted to the description of new and interesting facets of the clinical and pathologic features of the rheumatic diseases. Other papers were devoted to therapeutic, physiologic, and metabolic studies. Features of the more important of these research developments will be discussed in the survey.

Requests for reprints and/or information should be directed to: Roger L. Black, M.D., National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, Bethesda 14, Md.

Physical Medicine and Rehabilitation in Law-Science: Its Value in Personal Injury Problems and Medicolegal Trial Technics. M. K. Newman. *(pp. 10-15)*

● The field of physical medicine and rehabilitation, by virtue of its extensive employment of objective technics, in the disturbances of the neuromusculoskeletal system, and associated diseases which require objective functional evaluation, offers the field of Law-Science the greatest opportunity for clarifying its many problems. The experience of the physiatrist in the use of the diagnostic and therapeutic measures defined in the objective tests such as the activities of daily living, range of motion testing, mechanical and myometer muscle testing, and with the extensive use of electronic recording devices and diagnostic medicine, permits the formulation of accurate and demonstrable information for legal judgment. By means of such methods as electromyography, chronaximetry, oximetry, circulation time testing and the like, it is possible to clarify the criteria proof necessary to govern the just appraisal and disposition of the various personal injury claims. Appropriate examples are presented in developing the criteria of the objective disability, capability, and the methods of evaluation to demonstrate the actual application in trial technics.

Requests for reprints and/or information should be directed to: Max K. Newman, M.D., Detroit Institute of Physical Medicine and Rehabilitation, 16861 Wyoming Ave., Detroit 21, Michigan.

Effect of Marsilid on Depression and Apathy in Chronic Physical Illness. J. R. Hodge, and F. C. Shontz. *(pp. 16-18; 2 tables)*

● A double blind study of the effects of Marsilid (iproniazid) and a placebo was made upon 13 patients who had chronic physical illnesses accompanied by symptoms of depression, apathy, withdrawal, and lack of motivation for rehabilitation procedures. All patients received psychological tests and psychiatric evaluations during the six-week study period. No significant changes, qualitatively or quantitatively were found in any of the three groups; and it is concluded that Marsilid alone, in the dosage employed (100 mg. per day), and in the absence of all psychotherapeutic technics, was of no significant value in the management of these conditions.

Requests for reprints and/or information should be directed to: James R. Hodge, M.D., 326 S. Main St., Akron 8, Ohio.

Perception in Hemiplegia: I. Judgment of Vertical and Horizontal by Hemiplegic Patients. H. G. Birch; F. Proctor; M. Bortner, and M. Lowenthal. *(pp. 19-27; 4 figures and 9 tables)*

● The present investigation of judgment of the visual vertical and horizontal is the first in a series of reports concerned with perceptual functioning in hemiplegic patients. The results indicate that systematic alterations in the visual perception of the vertical and horizontal occur as important sequelae of the neurologic damage that results in hemiplegia. These results are discussed in terms of their implications for rehabilitation practice and their significance for neurologic and perceptual theory.

Requests for reprints and/or information should be directed to: Morton Bortner, Ph.D., New York Medical College, Department of Physical Medicine and Rehabilitation, 1 E. 105th St., New York 29, N. Y.

FEBRUARY

Surgical Considerations of Hand Rehabilitation. J. L. Bell. *(pp. 45-53)*

● The anatomy and kinesiology of the hand will be reviewed from the standpoint of diagnosis and management of acute injuries and reconstructive surgery of the hand. In the main, there are three types of injuries to the hand; sharp lacerations involving tendons and nerves; crushing injuries which involve not only the covering tissues, but may involve bones, joints, tendons and nerves; and lastly, thermal burns of the hand. Although skilled primary care may obviate the necessity for additional reparative procedures in many types of trauma to the hand, crushing injuries are frequent exceptions. In the latter an optimum restoration of function is accomplished only after one or more secondary operations, even though the initial wounds may have healed without infection, tissue necrosis, or excessive scarring. If these disastrous conditions have intervened, problems of reconstruction are compounded and the ultimate result is far from satisfactory. It is well recognized that adequate, early initial surgery is the foremost deterrent to these complications following mutilating trauma of the hand. Crushing injuries vary in extent, depth and location. Frequently more than one type of tissue is involved. However, covering tissues of the hand are most commonly damaged in open crush injuries. Deeper structures which should be considered are tendons, nerves, intrinsic muscles, bones

and joints. To determine its efficiency, the injured hand should be re-evaluated when all wounds are soundly healed. A knowledge of anatomy and basic functions of the hand is essential to assess properly all situations encountered following maximum healing of tissues. Although secondary procedures may have been anticipated from the time of initial surgery, some may not be necessary following a reasonable trial of time and use. Loss of sensation may be a greater disability than loss of active motion. Stability with intact sensation is often more useful than active movement in a digit which lacks feeling. Mobility of stiffened interphalangeal joints cannot be corrected satisfactorily by surgical methods; however, motion at metacarpophalangeal joints often is improved following lateral capsulotomies. Loss of function after irreparable destruction or long standing paralysis of intrinsic muscles may be partially overcome, if joint mobility has been preserved along with sufficient motor components which can be utilized for substitution. Following tendon injuries, an increase in active extension or flexion of digits is possible, provided that intervening joints and surrounding tissues permit either secondary repair or tendon grafting as necessary. In many instances the problems of reconstruction to provide even minimal restoration of function may be complex.

Requests for reprints and/or information should be directed to: John L. Bell, M.D., Department of Surgery, Northwestern University Medical School, 303 E. Chicago Ave., Chicago 11, Ill.

Evaluation and Treatment of Lower Motor Unit Lesions Involving the Shoulder, Arm, Forearm, and Hand. R. L. Bennett. *(pp. 54-61)*

● The physician who accepts the responsibility of caring for a patient with muscle weakness following a lower motor neuron lesion must understand the reaction of the motor unit to disease and trauma, and must have the ability to determine the site and extent of the lesion so that he can precisely prescribe and personally treat, or supervise the treatment of, his patients. Diagnosis must be based on an accurate history and specific objective findings. These findings are obtained through observation of bodily movement, specific muscle strength testing, and electronic analysis of motor unit function. The program of care is based on the apparent contradiction that while full recovery is expected, something less than full recovery is anticipated. With this basis in mind, the technics and devices used to promote recovery must in no way limit the possibilities of functional devices and orthopedic surgery if full recovery does not take place. In general, the treatment program is made up of four components: (1) proper support of weakened bodily segments; (2) intelligent mobilization; (3) specific muscle reeducation, and (4) specialized functional analysis and training with or without specialized orthetic devices and modified environment consistent with the site and degree of residual weakness.

Requests for reprints and/or information should be directed to: Robert L. Bennett, M.D., Executive Director, Georgia Warm Springs Foundation, Warm Springs, Ga.

Psychiatric Considerations of Hand Disability. S. H. Fisher. *(pp. 62-70)*

● Consideration of the psychiatric aspects of hand disability must be directed toward an elaboration of the meaning of the hand and its disabilities to the individual, and the various factors involved in determining this meaning. In its general aspects, the biological evolution of the hand and its effect on the function of the individual, the social and anthropological significance of the hand is considered. In its more specific aspects, hand disabilities are discussed from the viewpoint of the special problems which are raised by amputation, prostheses, phantom limb, paralysis, deformity, handedness, and congenital versus acquired disability. Finally, the personality of the individual with hand disability is considered, indicating how this factor contributes to the meaning of the disability and the various modes of adaptation to it.

Requests for reprints and/or information should be directed to: Saul H. Fisher, M.D., Assistant Professor of Clinical Psychiatry, New York University College of Medicine, New York, N. Y.

Perception in Hemiplegia: II. Judgment of the Median Plane. H. G. Birch; F. Proctor; M. Bortner, and M. Lowenthal. *(pp. 71-75; 1 figure and 5 tables)*

● A group of hemiplegic patients and control patients were examined in a task which involved the perception of the median plane under **dark** and **light** conditions. Under dark conditions, the total hemiplegic group showed significantly larger median plane alterations than did the control group. Both the right hemiplegic and left hemiplegic groups perceived the median plane to be significantly displaced to the affected side of the body. Under light conditions, median plane alterations were markedly reduced, but the hemiplegic group still showed significantly greater errors than did the control group. The results are discussed in connection with the alteration in the mechanisms of median plane perception in hemiplegia.

Requests for reprints and/or information should be directed to: Morton Bortner, Ph.D., New York Medical College, Department of Physical Medicine and Rehabilitation, 1 E. 105th St., New York 29, N. Y.

MARCH

The Ninth John Stanley Coulter Memorial Lecture: Tomorrow's Physiatrist. R. L. Bennett. *(pp. 89-94)*

● Because of the very nature of the diseases he cares for, tomorrow's physiatrist will be thoroughly oriented in the concept of total rehabilitation. However, he will not think of himself as specializing in "total rehabilitation," but in the over-all care of a well-defined group of diseases that primarily affect the neuromuscular and musculoskeletal systems. For adequate care of many of his patients with these diseases, he will need the advice and skill of other medical and surgical specialists. For his patients who need more than definitive medical and surgical care, he will utilize the skills of many paramedical disciplines. He will have the ability to interpret, correlate, and utilize test data from these disciplines much as any physician or surgeon, regardless of specialty, now utilizes data received from the x-ray department or the clinical laboratory. In essence, the physiatrist of tomorrow will be a physician with specialized interest and training capable of anticipating, recognizing, and handling the problems inherent in the care of those diseases with which the field of physical medicine and rehabilitation is most concerned.

Requests for reprints and/or information should be directed to: Robert L. Bennett, M.D., Executive Director, Georgia Warm Springs Foundation, Warm Springs, Ga.

Psychological Aspects of the Development of Speech and Language. E. Henrikson. *(pp. 95-102)*

● The development of human speech and language depends on a complex interaction between the individual and his environment. Basic to this development is an adequately functioning organism, variations in which can lead to delayed or deviant development. Psychological factors play an important part in determining how influential such variations will be. The general ability level of a person in such areas as intelligence affects his speech and language. Motivation is important for without it, inherent speech and language potentials may not be realized. The general adjustment pattern of the child is very influential. Speech and language represent significant facets of a child's self realization and of his relationship pattern to his social environment and are related to his total development in these areas. The results of psychological trauma on speech and language development emphasize the importance of psychological factors. Psychological influence is evident in all phases of language development ranging from effects on specific sound production through effects on the total language pattern.

Requests for reprints and/or information should be directed to: Ernest Henrikson, Ph.D., 205 Shevlin Hall, University of Minnesota, Minneapolis 14, Minn.

Clinical Problems in Speech and Language. N. E. Wood. *(pp. 103-110)*

● Speech pathologists are concerned with the rehabilitation of a wide assortment of problems that impede or interrupt communication. Research has shown that speech and language disorders occur randomly throughout the population without regard for age, sex, race, or socioeconomic level. Since speech is a learned function, speech disorders, whether congenital or acquired, are

either symptomatic of another problem or causally connected with a more basic disorder. For this reason, the speech pathologist most often functions as a part of a rehabilitation team. Speech disorders cannot be considered peripheral problems. Although disorders of voice, articulation, stuttering, hearing and aphasia, or associated problems of cerebral palsy or cleft palate are often brought to the attention of the speech pathologist, diagnostic information and suggestions for treatment must be available from all other personnel who have examined and/or treated the patient. The role of the speech pathologist must be removed from demands for miracles, for these demands can only result in quackery. Speech pathology must remain a scientific investigation with practical planning, imaginative procedures and hard work. Because of this wide diversification of speech and language problems, the aspect of language disorders will be emphasized in this report. In general, this discussion will be concerned with the rehabilitation of language disorders as they occur in both children and adults. More specifically, the subject matter will be related to aphasia, alexia and agraphia as caused by cerebral vascular accidents, brain tumors, or head injuries and congenital aphasia caused by anoxia, febrile episodes or birth injury. Clinical definitions of these problems, diagnostic needs and therapeutic suggestions will be presented.

Requests for reprints and/or information should be directed to: Nancy E. Wood, Ph.D., 11206 Euclid Ave., Cleveland 6, Ohio.

Self-Help Prosthetic Device to Facilitate Locking and Unlocking of Long-Leg Braces. F. Becker. *(pp. 111-112; 5 figures)*

● The "Boomerang" is a device that might make the difference between a patient being able or not being able to extend his long-leg braces to the lock position without aid. This device is offered on the chief merit of overcoming these mechanical disadvantages aside from the fact that it facilitates the use of weakened upper extremities and reduces overall energy and man hour costs. The "Boomerang" is extremely rugged and repairs are seldom necessary even after years of continuous use.

Requests for reprints and/or information should be directed to: Folke Becker, M.D., VA Center, Dublin, Ga.

New Type Ergograph. D. K. Mathews; K. L. Pell, and N. H. Shoup. *(pp. 113-114; 2 figures)*

● An ergograph built by the Division of Industrial Research through cooperation with the Fitness Laboratory in the School of Physical Education at the State College of Washington is described and illustrated.

Requests for reprints and/or information should be directed to: Donald K. Mathews, D.P.E., 337 W. 17th Ave., Columbus 10, Ohio.

APRIL

Height and Weight of Children with Cerebral Palsy and Acquired Brain Damage. H. M. Sterling. *(pp. 131-135; 4 figures and 6 tables)*

● Height and weight records of 100 patients with brain damage occurring prenatally, paranatally or in early childhood have been compared with those of the normal population at the same age, where possible. Data regarding the height and weight in the group with prenatal and paranatal brain damage (cerebral palsy) is less than would be expected. A small group of children acquiring brain damage later did not show as great differences from the predicted height and weight for normal individuals of the same age.

Requests for reprints and/or information should be directed to: Harold M. Sterling, M.D., Joseph P. Kennedy, Jr. Memorial Hospital, 30 Warren Street, Brighton 35, Mass.

Medical and Vocational Evaluation of Young Adult Cerebral Palsied: Experience and Followup, 157 Cases. S-J. Yue, and M. G. Moed. *(pp. 136-142; 11 tables)*

● Since 1955, 157 young adult cerebral palsied patients have gone through a work classification and evaluation project. Through medical examination, activities of daily living tests in physical and occupational therapy, psychometric studies, speech and hearing evaluations, and psychiatric examinations were carried out as they entered. These patients were then subjected to vocational evaluation in a special cerebral palsy workshop for a period of seven weeks. Predictions were made as to employability: that of the 157 patients, 52 per cent would be employable; 14 per cent had borderline employability; and 34 per cent would not be able to enter the competitive labor market. In follow-up study of 126 cases, it was found that 56 per cent of the patients in the predicted employable group had over 25 per cent of employment during the follow-up period and that 94 per cent of the patients predicted to be unemployable were unemployed. Of the individual medical test factors measured, only the physical therapy activities of daily living was significantly related to the vocational accomplishment, but the composite of both the physical factors and mental factors was more predictive of success than any one factor. There was some evidence that a minimal predictive score may furnish a basis for realistic prediction of job chances, but many immeasurable individual and chance factors enter into the achievement of vocational success.

Requests for reprints and/or information should be directed to: Shyh-Jong Yue, M.D., 630 W. 168th St., New York 32, N. Y.

Chronic Physical Illness as Threat. F. C. Shontz; S. L. Fink, and C. E. Hallenbeck. *(pp. 143-148; 1 table)*

● Ever since the concept of man as a psychobiological unit has been accepted, medical workers have found it necessary to seek explanations from psychiatrists, psychologists, and social workers for the behaviors of their patients. All too frequently, physical illness often serves the purpose of gaining satisfaction for security needs and other psychosocial wants without any special stigma or shame being attached to the sick person's behavior or to his feelings about himself. This study points up empirical evidence of the fact that personal values of the physically disabled are not always primarily concerned with getting well, even though the disabled do tend to be somewhat more concerned with physical functioning than do healthy persons.

Requests for reprints and/or information should be directed to: Franklin C. Shontz, Ph.D., Highland View, Cuyahoga County Hospital, 3901 Ireland Drive, Cleveland 22, Ohio.

A Modified Coaxial Electrode for Electromyography. R. O. Becker, and J. T. Chamberlin. *(pp. 149-151; 3 figures)*

● A modification of the standard coaxial electrode is presented along with investigation of its electrical parameters. This type of probe has been in use for two years and has been found to offer advantages such as reproducibility of results; complete coaxial shielding throughout; durability and handling ease; cold sterilization is easily accomplished and efficient, as well as ease of manufacture. The design produces an exceptionally convenient and durable electrode and eliminates the variables produced by frequent replacement of the standard type.

Requests for reprints and/or information should be directed to: Robert O. Becker, M.D., Chief, Orthopedic Service, VA Hospital, Irving Avenue and University Place, Syracuse 10, N. Y.

Active Immobilization for Arthritic Wrists and Knees. M. Kelly. *(pp. 152-157; 3 figures)*

● Rheumatoid arthritis is characterized by acute attacks in individual joints. Most of the disability comes from acute attacks on knees and wrists, which are held flexed until they cannot be straightened. Disabilities of fingers are usually secondary to arthritis of the wrist; the most common cause of inability to walk is a flexion deformity of the knees. Flexion deformities can be prevented by immobilization of acutely inflamed knees and wrists in extension; the hand should be used and the leg should be walked on. Flexion deformities of knees and wrists should be corrected under general anesthesia; immobilization should then be performed. If the joint has any cartilage, flexion returns after these procedures. If there is no cartilage, the patient is grateful for a painless ankylosis in good position.

Requests for reprints and/or information should be directed to: Michael Kelly, M.D., Institute of Rheumatology, 410 Albert St., East Melbourne, Australia.

MAY

An Electromyographic Study of the Extrinsic-Intrinsic Kinesiology of the Hand: Preliminary Report. C. Long; M. E. Brown, and G. Weiss. *(pp. 175-181; 9 figures)*

● A combined electromyographic and cinematographic study of the intrinsic-extrinsic kinesiology of the hand has been undertaken at Highland View Hospital, Cleveland. Motion pictures of the hand were taken from the lateral view with the wrist unsupported in recurrent opening and closing motions. Simultaneous eight-channel electromyography was performed on the intrinsic and extrinsic musculature of the hand using skin electrodes and 37 micron copper or stainless steel wire electrodes. The recordings are synchronized and matched. Data is reduced to produce joint motion curves, to which the electromyographic output is correlated. Data is further reduced through the use of mathematical methods and an IBM 650 computer to give information concerning velocity and acceleration of the various segments of the hand during the test motion. The phasic relationships of intrinsic and extrinsic musculature are studied, with particular emphasis on the function of the intrinsics in opening and closing the hand. Qualitative findings are primary, and quantitative findings secondary only.

Requests for reprints and/or information should be directed to: Charles Long, II, M.D., Highland View Hospital, 3901 Ireland Drive, Cleveland 22, Ohio.

Muscle Relaxants in Cerebral Palsy; A Comparative Study. I: Meprobamate. H. M. Sterling. *(pp. 182-184; 3 tables)*

● A method of objective observation for the influence of drugs on the motor behavior of children with cerebral palsy is available in spite of the differences shown in maturity, skill, motor handicap and between successive periods of time for each child as well as the more obvious differences between children. Meprobamate showed no effect in specific doses for a prescribed period of time when compared with pre- and post-medication performance of children with spasticity due to brain damage. Side reactions were no more frequent during use of the drug than during use of the placebo.

Requests for reprints and/or information should be directed to: Harold M. Sterling, M.D., Joseph P. Kennedy, Jr. Memorial Hospital, 30 Warren St., Brighton 35, Mass.

Motor Nerve Conduction Velocity Studies in Poliomyelitis. E. W. Johnson; J. D. Guyton, and K. J. Olsen. *(pp. 185-190; 5 figures)*

● During the late summer and fall of 1958, 100 patients were admitted to Children's Hospital (Columbus, Ohio) with the clinical diagnosis of acute paralytic poliomyelitis. At various stages in their illness, conduction velocity studies were performed on all the patients. The findings are presented and the diagnostic value of motor nerve conduction velocity determination in the differential diagnosis of polio-like diseases is discussed.

Requests for reprints and/or information should be directed to: Ernest W. Johnson, M.D., 2470 Cranford Road, Columbus 21, Ohio.

Kinesiology of the Temporomandibular Joint. S. I. Silverman. *(pp. 191-194)*

● A study of the kinesiology of the temporomandibular joint is discussed in relation to the functions of speech, respiration, mastication, deglutition, head posture and the special senses. It includes cineradiographic observations of the temporomandibular joint and the pharyngeal musculature; electromyographic records of the muscles associated with joint movement; three dimensional studies of the functional and extreme ranges of movement of the joint; the neurophysiologic mechanisms and the psychologic components of the joint function. The study discusses the therapeutic implications in the field of physical medicine and rehabilitation in relation to nutrition, speech re-training, body posture and the psychological well being of the patients. It also discusses the similarity between the common clinical problems of temporomandibular joint pain syndrome and low back pain syndrome.

Requests for reprints and/or information should be directed to: Sidney I. Silverman, D.D.S., 80 Park Avenue, New York 16, N. Y.

Development of the Prevocational Unit: Stanford Rehabilitation Service. M. Acker, and D. A. Thompson. *(pp. 195-198)*

● The prevocational unit is visualized as one to be used for the evaluation of vocational potential of rehabilitation service patients, people who are presumably vocationally handicapped. This unit is also viewed as being an additional diagnostic tool, rather than as a replacement of other existing modalities. It should be used widely but not indiscriminately. The major medium of the prevocational unit will be work sample testing. The data derived from work sample testing will go beyond the identification or classification of factors pertinent to vocational capacity and will allow for the assessment of durability of these factors in time. It is also used in the teaching of rehabilitation concepts and work measurement technics to students in various specialties through observation and student participation in the testing procedures.

Requests for reprints and/or information should be directed to: Martin Acker, Vocational Counselor, Rehabilitation Service, Stanford University School of Medicine, Department of Preventive Medicine, 2330 Clay St., San Francisco 15, Calif.

JUNE

Pulmonary Function Tests in Rehabilitation. A. W. Brody. *(pp. 215-219; 1 table)*

● Uses of pulmonary function tests are described with relation to the physiologic subdivisions of the processes of respiration. The applications are described in detail for paralyzed patients undergoing rehabilitation. For contrast, typical findings in emphysema are presented.

Requests for reprints and/or information should be directed to: Alfred W. Brody, M.D., Creighton Medical School, 14th and Davenport, Omaha 2, Neb.

Basic Anatomy and Neurophysiology of Speech and Language. G. Kelemen. *(pp. 220-225; 2 figures)*

● Throughout lifelong evolution, anatomical changes remain in very close relation with the quantity and quality of the vocal output. To the changes occurring in the larynx itself, those appearing in the resonating tube have to be added. Growth around the oral, pharyngeal and nasal-paranasal cavities influence the vocal production. They add to its definite and individual character in such a far-reaching manner that single persons are in general easily identified merely by listening to their speech. Vocal individuality is reached by evolution, different for each person, of the profiles of cavities which make up the resonating tube. The larynx is the source of the sound, but it is not to be considered as the organ of speech. It produces the raw material in the form of sound which is modified into voice by resonating chambers located above and below the larynx. To become speech, collaboration of the pharynx, tongue, palate, lips, and nasal cavity is necessary. It may be permissible to throw a glance in the direction of the future of laryngeal development and ask if the human vocal cord and its productions were not overshot in some other species.

Requests for reprints and/or information should be directed to: George Kelemen, M.D., 243 Charles St., Boston 14, Mass.

Muscle Relaxants in Cerebral Palsy; A Comparative Study. II: Chlorophenylmethylthiazanone Sulfone (Trancopal). H. M. Sterling. *(pp. 226-228; 3 tables)*

● Four children having spasticity, athetosis, or both, affecting the control of the upper extremities were given Trancopal in a specified dose for six weeks. Comparison of each child's performance on a specially selected test designed to show possible improvement in rate of manual manipulation during the control period and the period of medication or placebo administration showed no significant change. Comparison of their performance with children who received a placebo failed to reveal any significant difference which could be attributed to a drug effect.

Requests for reprints and/or information should be directed to: Harold M. Sterling, M.D., Joseph P. Kennedy, Jr. Memorial Hospital, 30 Warren St., Brighton 35, Mass.

Pre- and Post-Partum Exercises: Technics, Indications, Benefits. G. C. Twombly. *(pp. 229-234)*

● The prescribing of both pre- and post-partum exercises is increasing. In a significant number of hospitals the responsibility for the administration and supervision of the exercise program is being assumed by the department of physical medicine and rehabilitation. This trend would seem to be a logical one since various forms of exercise comprise an integral and most important part of the activity of any department of physical medicine and rehabilitation. Success of the program depends upon cooperation between obstetrical and physical medicine departments. Exercise technics; methods of instruction; acceptance of program by patient and doctor; physical and psychological benefits; anatomical considerations; limitations and precautions; relation to so-called Natural Childbirth Methods; role of the physical therapist, physiatrist and obstetrician and methods and problems of evaluation are discussed. This report is partially based upon the results of a four-year study (1955-1958) conducted in a private hospital with 5,047 maternity patients.

Requests for reprints and/or information should be directed to: George C. Twombly, Jr., M.D., 1818 Humboldt St., Denver 18, Colo.

JULY

Decrease in Muscle Spasm Produced by Ultrasound, Hot Packs, and Infrared Radiation. F. P. Fountain; J. W. Gersten, and O. Sengir. *(pp. 293-298; 3 figures)*

● Static force balance was used to measure the resistance to passive lateral flexion of the neck in patients with neck muscle spasm, and to passive extension of the leg in patients with poliomyelitis. The effect of hot packs, ultrasound, and infrared on this spasm was noted. All three technics decreased spasm in both groups of patients. Hot packs were, however, significantly most effective in poliomyelitis patients, while ultrasound was significantly least effective in neck spasm.

Requests for reprints and/or information should be directed to: Freeman P. Fountain, M.D., Dept. of Physical Medicine, 4800 Gibson Blvd., S.E., Albuquerque, N. M.

Electromyographic Findings in Adults with Myxedema: Report of 16 Cases. R. R. Ozker; O. P. Schumacher, and P. A. Nelson. *(pp. 299-307; 3 tables)*

● Though electromyography is now widely utilized as a diagnostic procedure, much remains to be learned concerning specific findings in various pathologic conditions. Myxedema, which can be considered a severe degree of hypothyroidism, is rarely seen in clinical practice today. It is a disease involving general metabolic activity and affects multiple systems within the body including the skin, blood, ear, nose and throat, heart and blood vessels, stomach and intestinal tract, genitourinary tract, and also the musculo-skeletal and nervous systems. It is not surprising that abnormalities are frequently seen on electromyographic study. This report summarizes the findings in 16 patients with primary or secondary myxedema.

Requests for reprints and/or information should be directed to: Ridvan R. Ozker, M.D., Cleveland Clinic Foundation, 2020 E. 93rd St., Cleveland 6, Ohio.

Special Problems in Total Medical Care of the Handicapped Patient After Hospital Discharge: Two Case Reports. O. Austlid. *(pp. 308-310; 3 figures)*

● When a disabled patient returns home after completed hospital care he faces many new and difficult problems. The achievement of maximum independence and the potentialities for gainful work are of prime importance. This phase of the patient's total care is often neglected. Two cases of poliomyelitis, which illustrate the multiplicity of problems and how teamwork helped to solve them, are presented. For one patient with quadriplegia an electric hoist was installed in his bathroom. This enabled him to care for his toilet needs and manage alone during the day while his wife was away on her job as a school teacher. For the second patient with paraplegia a new apartment without stairs, a car with hand controls and a suitable job were provided. Similar problems are encountered by any patient suffering from an illness that necessitates changes in living habits or vocation. It is important that physicians in general become more aware of the importance of this phase in the patient's total care.

Requests for reprints and/or information should be directed to: Olav Austlid, M.D., 535 E. 70th St., New York 21, N. Y.

AUGUST

An Approach to Disability Evaluation. L. I. Kaplan; J. S. Tobis, and M. Lowenthal. *(pp. 337-345; 6 figures)*

● Because measuring yardsticks in medicine frequently are based on inadequate clinical data there is a need for accurate methods of measurement. This is true especially in physical medicine and rehabilitation since it is one of the younger specialties. The need particularly is felt in functional evaluation and prognosis; the inadequacies in these areas being pinpointed by a study of 400 patients with functional deficiencies living in nursing homes. Some significant findings include: many patients, thought previously to have functional deficiencies in activities of daily living, were able to perform independently when given an objective activities of daily living test in a place other than the patient's usual residence; lack of agreement existed between competent physicians in their estimations of the patients' suitability for rehabilitation; disagreement was found as to which were the key factors in formulating decisions of patient acceptability, and early results in many patients did not bear out the recorded prognostications of physicians. Important factors, listed by a number of physiatrists, in evaluating the disabled patient were grouped into four major categories on forms and then organized for the major conditions seen in the geriatric nursing home population. The projected technic of measurement was tested by several physiatrists on 60 patients of a hospital's rehabilitation service, problem areas were noted and the forms modified accordingly. Patients in the nursing home study are being tested with these forms. When this larger study is completed it will be analyzed to ascertain the data's validity and in an attempt to develop an improved prognostic method. The use of the forms, therefore, is a proposed first step in the direction of objectifying evaluation in rehabilitation.

Requests for reprints and/or information should be directed to: Lawrence I. Kaplan, M.D., 11 Shrub Hollow Road, Roslyn, L. I., N. Y.

Correlation Between Fibrillation Potentials and Abnormal Chronaxies. W. T. Liberson, and R. Pavasars. *(pp. 346-350; 2 figures and 2 tables)*

● This study was carried out in patients with diffuse peripheral neuropathies, nerve injuries, anterior horn involvement, and myopathies. The total number of muscles investigated was 1,665. There is a high percentage of muscles showing fibrillation potentials when the chronaxie is above 20 milliseconds. The frequency of occurrence of fibrillation potentials markedly decreases for muscles with chronaxies below 20 milliseconds, and only 20-35 per cent of muscles with abnormal chronaxies of 1-3 milliseconds were found to be fibrillating. Almost the same percentage of fibrillating potentials was found for muscles with normal chronaxies in patients presenting lower motor neuron disturbances. These results are discussed.

Requests for reprints and/or information should be directed to: W. T. Liberson, M.D., Chief, PM&R Service, VA Hospital, Hines, Ill.

Heterotopic Ossification, a Problem in Rehabilitation Medicine. H. Lippmann. *(pp. 351-353)*

● Extraskeletal bone formation may complicate a number of disabling diseases and may interfere with rehabilitation procedures. As an example, some problems arising from periarticular ossification in spinal cord diseases are discussed. The occurrence of subcutaneous

ossification in the legs, associated with chronic venous insufficiency, was recently described by the author. Some studies into the pathogenesis of this condition are discussed, insofar as they may help to clarify the understanding of extraskeletal ossification elsewhere.

Requests for reprints and/or information should be directed to: Heinz Lippmann, M.D., 1192 Park Ave., New York 28, N. Y.

SEPTEMBER

A Study to Determine the "Energizing" Effects of Iproniazid (Marsilid) on a Group of Hemiplegics. C. Casella, and J. Sokolow. *(pp. 381-385; 2 tables)*

● A sample of 60 white males with hemiplegia on the right side were selected for inclusion in this study because of poor motivation for rehabilitation while inpatients in a physical medicine and rehabilitation service. The patients were tested on an overt level through physical ability scores and a covert level through Rorschach component scores and divided into two groups equated as to pretreatment scores on these measures. Thirty were included in the experimental group (iproniazid), and the remaining 30 were placed in the control group (placebo). Treatment extended over a six-week period. Upon termination of treatment, physical activity and Rorschach scores again were obtained and compared with the predrug scores. Significant gains were registered by the experimental group as demonstrated by the physical activity scores, while the control group showed no significant change at this overt level. Covert response measures as determined by the Rorschach scores showed no statistically significant change for either the experimental or control group. Possible explanations of this discrepancy between results of overt and covert measures are discussed.

Requests for reprints and/or information should be directed to: Mr. Carmine Casella, M.S., B406, Armstrong Hall, E. Lansing, Mich.

Condensation of Symposium on Mouth-to-Mouth Resuscitation (Expired-Air Inflation). R. E. DeForest. *(pp. 386-393; 3 figures and 5 tables)*

● Research, reported in this symposium, indicates that resuscitation with expired-air breathing is simple and effective. It is especially useful in cases of injury to the body. It is adaptable to infants, children and adults without adjunct equipment. With adjunct equipment it is adaptable to many specialized resuscitation problems, such as in contaminated atmospheres. Expired-air breathing should be performed with inflation volumes about twice the resting tidal volume of the victim at a rate of 12 to 20 per minute. Reserves of pressure and volume can be mustered easily to overcome unusual handicaps. The removal of carbon dioxide and the supply of oxygen can be kept within safe limits. Rescuers can maintain mouth-to-mouth breathing for an hour or more without fatigue even though the victim is physically larger than the rescuer. Obstruction of the airway above the larynx is the most common cause of failure of any method of artificial respiration. In expired-air breathing, this type of obstruction is prevented because the hands are free to keep the head extended at the atlanto-occipital joint and the lower jaw displaced forward. If there is an obvious mechanical obstruction in the airway, the first step is to remove it. If there is no obvious obstruction, mouth-to-mouth breathing is begun at once. It permits breath-by-breath assay of the presence of obstruction, degree of inflation, and degree of relaxation of the victim's chest. Techniques, requirements and results are elaborated upon in this condensed study.

Requests for reprints and/or information should be directed to: Ralph E. DeForest, M.D., Council on Medical Physics, American Medical Assn., 535 N. Dearborn St., Chicago 10, Ill.

Effect on Coronary Circulation of Cold Packs to Hemiplegic Shoulderr E. J. Lorenze; G. Carantonis, and A. J. DeRosa. *(pp. 394-399)*

● The evaluation is presented of the possible effect on coronary circulation of the use of cold packs to hemiplegic shoulders. In 20 subjects **without** heart disease no significant electrocardiographic or clinical changes were noted. In 25 subjects **with** known coronary artery disease (including 15 subjects with left hemiplegias) one patient with left hemiplegia showed significant RS-T segment depression with T wave inversion. It is not expected that the relatively minor skin and intramuscular temperature changes will cause significant reflex vasoconstriction of the coronary arteries, or other hemodynamic changes, but it apperently can occur and must be considered a possibility if such therapy is undertaken. Experience with cold packs in hemiplegia, noted in this study, shows that patients reported reduction of pain and better tolerance for stretching temporarily; in some instances pain diminished or disappeared after seven to 12 daily cold applications.

Requests for reprints and/or information should be directed to: Edward J. Lorenze, M.D., Burke Foundation, White Plains, N. Y.

Motivation in Rehabilitation of the Physically Handicapped. M. D. Zane, and M. Lowenthal. *(pp. 400-407)*

● In a previous paper, a conception was developed relating personality traits, performance and stress. In this study the authors elaborate the implications of this conception for the problem of motivation — universally regarded as of prime importance to a patient's success in his rehabilitation program. We are concerned with the question of how the motivation of rehabilitation problem cases is changed during treatment from "poor" to "good." Generally the term "poor motivation" is applied to: 1. Patients who refuse to try the prescribed task; 2. Patients who try but give up quickly; 3. Patients who keep trying but fail to learn. Cases of each category are presented in which motivation was changed from "poor" to "good." Motivation is seen as a complex of forces — some interfering with and some disposing towards effort and learning. Thus, negative and positive motivational factors exist. Negative motivational factors arise in states of increasing stress while positive motivational forces develop with decreasing stress. Clinically, increasing stress develops as the patient is unable or anticipates being unable to achieve what he is trying to do. Decreasing stress ensues as the patient becomes able or anticipates being able to achieve his goal. Rehabilitation therapy strengthens and develops positive motivational factors and weakens and eliminates negative ones by affecting the patient's goals and actions so as to improve his ability to achieve what he is trying to do.

Requests for reprints and/or information should be directed to: Manuel D. Zane, M.D., 15 East 36th St., New York 16, N. Y.

OCTOBER

Pathologic and Clinical Characteristics of Connective Tissue Diseases. H. F. Polley, and C. H. Slocumb. *(pp. 425-433)*

● The connective tissue diseases still present a real challenge to the clinician's diagnostic and therapeutic abilities, but knowledge of the pathologic changes and physiologic aspects of connective tissue and careful attention to clinically recognized variations in the manifestations of connective tissue diseases can be helpful.

Certain previously accepted concepts relating to connective tissue diseases now are being revised as a result of intensive clinical and laboratory studies. With increased efforts to recognize and to differentiate the various connective tissue diseases and treat them more appropriately, it is likely that a more optimistic outlook will be justified.

Requests for reprints and/or information should be directed to: Section of Publications, Mayo Clinic, 200 First St., S.W., Rochester, Minn.

Preliminary Report of Evaluating and Classifying the Vocational Potential of the Cerebral Palsied. O. Machek, and H. A. Collins. *(pp. 434-437; 5 tables)*

● A medically supervised, vocational program of 16 months duration, involving young adults with cerebral palsy, is being analyzed. The patients are classified into four categories. More than 100 patients are being screened. Manual dexterity, basic vocational tools and equipment, and basic academic skills are tested. Practical conclusions are presented.

Requests for reprints and/or information should be directed to: Otakar Machek, M.D., 634 N. Grand Blvd., St. Louis 3, Mo.

Use of Ultrasound in the Treatment of Pressure Sores in Patients with Spinal Cord Injury. B. J. Paul; C. W. Lafratta; A. R. Dawson; E. Baab, and F. Bullock. *(pp. 438-440; 3 figures)*

● Based on clinical observations alone the authors believe that ultrasonic therapy in pressure sores is effective in relieving congestion, cleansing necrotic areas and promoting healing with healthy, nonadherent skin approaching normal thickness. This was especially striking in areas directly over bony prominences such as the sacrum. It is probable that the effect of ultrasound on membrane permeability and the size of the protein molecule play a major role, aside from the heating effect which, in this series, was most likely negligible. From clinical observations it would appear that a scientifically controlled study in this area would be richly rewarding.

Requests for reprints and/or information should be directed to: A. Ray Dawson, M.D., PM&R Service, VA Hospital, Richmond 24, Va.

Diagnostic Challenge of Back Pain. L. Policoff. *(pp. 441-445)*

● When a patient presents himself for examination with a primary complaint of back pain it is commonly assumed that the most likely etiological basis for the difficulty is a musculoskeletal disorder. In actuality even in those instances in which trauma to the musculoskeletal system is a known factor the symptoms are not always related. The human back can mirror referred pain from a diversity of other anatomical sources and etiologic agencies. Some of the more significant causes of back pain encountered in the course of a consulting practice in general hospitals during the past five years is reviewed and analyzed. Their importance to the physiatrist is self-evident, and this survey concludes the physiatrist is the clinician most capable of assessing the true meaning of back pain.

Requests for reprints and/or information should be directed to: Leonard Policoff, M.D., Dept. of PM&R, Albany Medical College and Hospital, Albany, N. Y.

Hospital-Centered Vocational Rehabilitation. R. H. Manheimer; R. Goldman; M. C. Brennan; K. R. C. Greene; P. Sumner, and J. G. Benton. *(pp. 446-451; 11 tables)*

● A vocational rehabilitation unit, operating as an integral part of a department of physical medicine and rehabilitation in a suburban community hospital, is providing comprehensive rehabilitation, including the evaluation and training of patients in performing jobs in the hospital's operating departments. The project will operate for three years. In the first 14 months, 91 handicapped persons were referred. Fifty-one cases were closed, including 29 who went to work.

Requests for reprints and/or information should be directed to: Robert H. Manheimer, M.D., Arthritis & Rheumatism® Foundation, 432 Park Ave., South, New York 16, N. Y.

Hydrotherapy Unit. R. E. Worden, and J. P. Zimmerman. *(pp. 452-456; 5 figures)*

● The plans, management, and usage of a custom-built hydrotherapy unit at Children's Hospital, Columbus, Ohio, are discussed. This unit, consisting of three separate compartments and constructed of stainless steel, has proved to have many distinct advantages over conventional hydrotherapy units and the usual floor level therapeutic swimming pool.

Requests for reprints and/or information should be directed to: Ralph E. Worden, M.D., U.C.L.A. Medical Center, 10833 Le Conte Ave., Los Angeles 24, Calif.

NOVEMBER

Use and Abuse of Certain Tools of Physical Medicine. R. L. Bennett. *(pp. 485-496)*

● The author presents an outline of the use and abuse of certain agents commonly used in the field of physical medicine. Each of these tools is essential in the most adequate care of most neuromuscular and musculoskeletal diseases. If misused, each is capable of limiting recovery and causing severe handicap. These tools include mobilization (used synonymously with "stretching") and its abuse, muscle re-education (therapeutic exercise) and its abuse, functional training and its abuse, and orthetic devices and their abuse. In no way decrying their use by emphasizing their abuse, the author indicates there is more truth than poetry in the saying "the brighter the light, the darker the shadow."

Requests for reprints and/or information should be directed to: Robert L. Bennett, M.D., Executive Director, Georgia Warm Springs Foundation, Warm Springs, Ga.

Adrenocortical Steroid Therapy for Rheumatic Diseases. H. F. Polley. *(pp. 497-503)*

● The management of rheumatic diseases has been greatly facilitated by the use of available adrenocortical hormones, their synthetic analogues, or ACTH, but careful attention to varying requirements of the disease and the individual patient is indicated. There is still room for improvement in the treatment of rheumatoid arthritis as well as certain other rheumatic diseases for which steroid therapy may be useful and helpful, and undoubtedly much will be learned regarding the appropriate use of the steroids with further experience. However, for the rheumatic diseases for which steroid therapy may be indicated and helpful, the several adrenocortical steroids currently available can now be useful and reasonably safe adjunctive therapy when used to best advantage within the limits of tolerable doses and as a supplement to the beneficial measures of nonsteroidal therapy.

Requests for reprints and/or information should be directed to: Section of Publications, Mayo Clinic, 200 First St., S.W., Rochester, Minn.

European Spas. W. Bierman; G. Bard; M. E. Knapp; W. D. Paul; E. P. Reese, and S. Winokur. *(pp. 504-513)*

● European spas, frequented by the ailing for many centuries, today are being visited in increasing numbers by the sick and by those who desire to prolong their life span of useful activity. They are being referred by their physicians who consider spa therapy as an integrated part of the overall medical care of their patients. Modern technology is affording objective, scientific explanations for the observed clinical results.

Requests for reprints and/or information should be directed to: William Bierman, M.D., 750 Gonzalez Dr., San Francisco 27, Calif.

Hypnosis, An Adjunct in the Treatment of Neuromuscular Disease. R. F. Baer. *(pp. 514-515)*

Read at the 3rd International Congress of Physical Medicine, Session on Medical Problems Diagnosed or Treated by Physical Medicine, Washington, D. C., August 25, 1960.

● Many diseases seen by the physiatrist can be greatly helped with the use of hypnosis. Certain distressing symptoms of neuromuscular disease can be alleviated substantially. Pain as seen in the whole disease realm can be obtunded or eliminated. Spasticity can be reduced in multiple sclerosis, syringomyelia, traumatic myelitis, etc., where partial function remains. Incontinence is readily controlled in spinal cord disease for long periods. The female paraplegic can learn bladder and bowel control and the male can learn the latter. Incoordination in the mild athetoid can be minimized greatly by conditioned relaxation which can be learned immediately in the trance state. This effect is of long duration. Phantom limb syndrome is easily treated with hypnotic suggestion and the time element in re-education of muscle function and prosthetic use can be reduced significantly. Protein and fluid intake in the debilitated patient can be increased to desired levels, increasing the healing rate of the too often seen decubitus ulcer and decreasing convalescent time. Hypnosis is no panacea but is a valuable adjunct to treatment of neuromuscular disease. It is not applicable to all patients and is a technic which may prove inefficient for some clinicians.

Requests for reprints and/or information should be directed to: Richard F. Baer, M.D., 1213 Elco Dr., Maumee, Ohio.

Adaptation to Marie-Strumpell Arthritis. E. W. Fowlks; J. A. Bridges, and D. Hopkins. *(pp. 516-521; 2 tables)*

● This study covers extensive research during the period 1926-1959 relative to adjustments of Marie-Strumpell arthritis patients discharged from the hospital. Geographic locations, accuracy of diagnosis, military and vocational histories, emotional, marital and work conditions have been considered. Factors responsible for motivation, or lack of motivation, have been worked out in detail from a medical, social and vocational point of view. Reasons for failures in adaptation to chronic diseases are clearly uncovered, and this points out possible reasons for our failure to rehabilitate fully many of our patients even though physical improvement has been very successful.

Requests for reprints and/or information should be directed to: Everill W. Fowlks, M.D., 431 Vista Rd., Oswego 3, Ore.

DECEMBER

Rehabilitation Operation for 10,000 Moroccan Paralysis Victims. G. Gingras, and M. H. L. Desmarais. *(pp. 559-563)*

Read at the 3rd International Congress of Physical Medicine, Session on Neuromuscular Diseases, Washington, D. C., August 24, 1960.

● Paralysis appeared in the Meknes area at the end of August, 1959, and by the end of November almost 10,000 Moroccans were affected. In mid-September, unable to cope with the situation, the Government and Moroccan Red Crescent appealed for assistance to World Health Organization (WHO) and the League of Red Cross Societies. Two WHO experts were dispatched to Morocco to investigate and they traced the cause of the paralysis epidemic to poisoning by tri-ortho-cresylphosphate contained in adulterated cooking oil. Dr. Dennis Leroy, a French professor, sent later as WHO expert on matters of re-education, submitted recommendations concerning establishment of rehabilitation centers, equipment, treatment, personnel and training. Findings revealed that 50 per cent of the victims were children and adolescents and that women were affected in greater number than men. Through its National Societies, the League provided equipment, financial assistance and 55 professional rehabilitation personnel from 15 countries to treat victims and to train Moroccan personnel. Locales were found and one indoor and four outdoor hospital treatment centers were established. Special 10-day courses for Moroccan nurses aides have been started to qualify them to assist physical therapists. A special one-year physical therapy training course is planned for selected Moroccan nurses. Six weeks after organization of the rehabilitation operation, 6,991 patients had been thoroughly evaluated and tested. Preliminary statistics show that of this number six per cent will remain quadriplegics, approximately 15 to 20 per cent have minimal disability and the balance will require long-term treatment. The size and urgency of the problem dictate group therapy treatment rather than individual treatment.

Requests for reprints and/or information should be directed to: Gustave Gingras, M.D., 6265 Hudson Rd., Montreal, Que., Canada.

Development of Objective Predictors of Recovery in Hemiplegic Patients. J. H. Bruell, and J. I. Simon. *(pp. 564-569; 1 figure and 2 tables)*

Read at the 3rd International Congress of Physical Medicine, Session on Medical Problems Diagnosed or Treated by Physical Medicine, Washington, D. C., August 26, 1960.

● Predictions as to whether a patient will recover after a cerebral vascular accident are made frequently on a subjective basis, and the validity of such predictions depends largely on the experience of the clinician who makes the prognosis. Data will be presented which suggest the distinct possibility of developing objective methods of prediction. Two groups of 40 hemiplegic patients form the two samples of this study. It was found that hemiplegic patients who fail to recover from the effects of a cerebral vascular accident (F-patients), (a) tend to be older, (b) tend to have higher systolic blood pressure, and (c) tend to enter physical therapy later after the c.v.a. than patients who recover (R-patients). Failure to recover was indicated if a patient remained wheelchair-bound in spite of physical therapy, while recovery was defined as a progression from a wheelchair-bound status at the beginning of physical therapy to an ambulatory and fully independent status at its conclusion. Measures of the three factors which differentiated between F-patients and R-patients were used as predictors of recovery. A composite score based upon all three factors was found to predict recovery better than scores based upon two or one factor only. Shortcomings of the method used in the development of the predictor scores, and ways to cope with these shortcomings in future studies will be discussed.

Requests for reprints and/or information should be directed to: Dr. Jan H. Bruell, Dept. of Psychology, Western Reserve University, Cleveland 6, Ohio.

Management of Emotional Barriers to Rehabilitation in Cerebral Palsied Adults. H. A. Storrow, and M. H. Jones. *(pp. 570-574)*

Read at the 3rd International Congress of Physical Medicine, Session on Cerebral Palsy, Washington, D .C., August 25, 1960.

● There is general agreement that a large proportion of cerebral palsied individuals suffer from emotional problems which interfere with rehabilitation efforts. Agreement is lacking, however, concerning the kinds of problems seen and appropriate methods for managing them. This investigation suggests that not one but several personality patterns are represented in this group. **Procedure:** 72 consecutive cerebral palsy patients applying for help to the United Cerebral Palsy Association of Los Angeles County Vocational Training Center were studied psychiatrically; information was recorded in narrative form and on specially prepared rating scales. **Findings:** 82 per cent of the subjects manifested the signs and symptoms of problems sufficiently severe to interfere with rehabilitation efforts, although not all were severe enough to warrant a psychiatric diagnosis. Four different personality patterns could be reliably distinguished: schizoid patterns, denial patterns, passive-dependent patterns, and sublimation patterns. The first three of these were maladaptive. **Conclusions:** most of the problems seen are amenable to management by the rehabilitation team without specialized psychiatric intervention. Appropriate management requires recognition and use of the constructive characteristics of each personality pattern. These characteristics and suggested methods for handling them are discussed.

Requests for reprints and/or information should be directed to: Hugh A. Storrow, M.D., Dept. of Psychiatry, University of Kentucky Medical Center, Lexington, Ky.

Comparison of the Bactericidal Effect of Visible Light with Ultraviolet Light on Staphylococcus Aureus. M. T. Carpendale. *(pp. 575-579; 4 figures and 1 table)*

Read at the 3rd International Congress of Physical Medicine, Session on Physiatric Care Following Trauma, Washington, D. C., August 25, 1960.

● It has been shown that long ultraviolet radiations (3000-3900 A.U.) have a bactericidal action on Mycobacterium tuberculosis (Segal & Bloch, 1955), and Escherichia coli (Luckiesh, 1947). However, this effect was not observed in the case of Staphylococcus aureus (Gates, 1930). The present study, using a high pressure mercury-xenon lamp demonstrates that not only is there a bactericidal action on Staphylococcus aureus with long ultraviolet radiations, but this effect is also observed with visible light, i.e., with a wavelength greater than 3900 A.U. This action seems to be dependent on the presence of oxygen, whereas the bactericidal action, due to wavelengths shorter than 3000 A.U. is independent of the presence of oxygen.

Requests for reprints and/or information should be directed to: Michael T. Carpendale, M.D., Director of Rehabilitation, University of Alberta Hospital, Edmonton, Alta., Canada.

Cervical Radiculitis: Diagnosis and Treatment. D. Rubin. *(pp. 580-586; 3 tables)*

Read at the 3rd International Congress of Physical Medicine, Session on Medical Problems Diagnosed or Treated by Physical Medicine, Washington, D. C., August 26, 1960. By title.

● The definition, diagnosis and method of treating cervical radiculitis are discussed. The objective of the active treatment program is to relieve the pain caused by nerve root compression by relaxing the cervical, scapular and shoulder musculature and by restoring a normal range of motion to the cervical spine. Specific modalities and specialized technics to achieve this objective are reported. Results of a study involving the response to treatment of 84 patients are given.

Requests for reprints and/or information should be directed to: David Rubin, M.D., 6360 Wilshire Blvd., Los Angeles 48, Calif.

The Effect of Weight Bearing Exercise on Radioactive Sodium Clearance from Normal and Osteoarthritis Knee Joints. L. H. Wisham; S. Davison, and L. Gordon. *(pp. 587-590; 2 tables)*

● As part of a continuing study into the circulatory physiology of the knee joint the authors have found that mild exercise and also the administration of intra-arterial Priscoline brings pain relief in the osteoarthritic knee. Their studies have shown that both procedures have the effect of decreasing Na^{24} clearance from the knee joint. The clearance rate indicates the proportional removal per minute. In the present study the normal group average clearance from the knee joint shows a highly significant response to very mild weight bearing muscular effort during exercise. The clearance rate then very rapidly returns to the resting clearance levels when exercise stops. The statistical significance is determined of differences between the average clearances of rest, during, and after exercise for normal subjects and osteoarthritic subjects.

Requests for reprints and/or information should be directed to: Lawrence H. Wisham, M.D., 1 E. 100th St., New York 29, N. Y.

Effects of Combined Denervation and Tenotomy on Skeletal Muscle. K. G. Wakim. *(pp. 591-593; 2 tables)*

Read at the 3rd International Congress of Physical Medicine, Session on Diseases of Skeletal Muscle, Washington, D. C., August 23, 1960.

● In adult albino rats a comparative study was made of the effects of tenotomy, denervation, and the combination of the two on the work output, endurance, and weight of the skeletal muscles attached to the tendo achillis. Denervation was achieved by high excision of the sciatic and femoral nerves at the base of the thigh. Tenotomy was effected by severance of the tendo achillis with overlap and suture of the cut end to prevent reinsertion to the os calcis. Four weeks after tenotomy and denervation the work output and weight were determined and compared with the same factors as derived from normal muscles. The muscle weights and the initial and total work output were reduced most severely by combined denervation and tenotomy. Denervation alone caused more reduction in muscle weight and in work output than did tenotomy alone. The average work output of the gastrocnemius muscle group in gram meters per 100 seconds was 196 for the normal muscles, 108 for those tenotomized, 24 for those denervated and 12 for those both denervated and tenotomized. Evidently the combination of tenotomy and denervation of the same muscle group has a practically additive effect on the muscles, causing a very marked reduction in muscle weight and in work output and endurance.

Requests for reprints and/or information should be directed to: Section of Publications, Mayo Clinic, 200 First St., S.W., Rochester, Minn.

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The holiday season is a very special time when we all reaffirm well-loved customs and fundamental beliefs. It is a joyful, eager time — rich with make-believe and laughter; a time of pride and pleasure, of memories of things past and imagining of things to come. It is a time of gratitude, compassion, hope and faith. Gratitude for the many blessings on this land and for trials withstood. Compassion for the less fortunate. Hope for a better world of peace and justice. Faith in our ability to grow and to build. For our way of life is a good one — strong and free and full of promise. It is in this spirit that the officers of the American Congress of Physical Medicine and Rehabilitation, the American Academy of Physical Medicine and Rehabilitation and the Editorial Board of the ARCHIVES extend to all members, readers, advertisers and friends warm greetings and good wishes this holiday season.

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